AMTRAK

High-Speed Trainset

Operating Instruction Manual

BOMBARDIER TRANSPORTATION ALSTOM

BOMBARDIER ALSTOM CONSORTIUM

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HOW TO USE THIS MANUAL

This manual has been prepared to serve as a guide to Amtrak personnel involved in the operation of the Bombardier Alstom Consortium High-Speed Trainset.

Trainset description and operating instructions are divided as follows:

PREFACE

This section includes an explanation of how to use the manual, the Warning Page, List of Revisions, Table of Contents, List of Illustrations, and List of Tables.

CHAPTER 1, INTRODUCTION

This chapter is divided into the following four sections:

Section 1.1, General Information — This section explains the scope of the manual, and provides a list of abbreviations and a glossary of the terms used in the manual.

Section 1.2, Equipment Description — This section briefly describes the equipment characteristics, with trainset data. It also provides external and internal views of the equipment showing the general features, essential operating items, and major components.

Section 1.3, General Description — This section includes a general description of the major systems of the High-Speed Trainset.

Section 1.4, Principles of Operation — This section briefly describes the principles of operation for the major systems of the High-Speed Trainset. Each subsection is dedicated to a major system, listed in the following order:

- 1.4.1 Carbody, Interior Fixtures, Operating Cab
- 1.4.2 Truck and Suspension
- 1.4.3 Coupler
- 1.4.4 Electrical Distribution System
- 1.4.5 Lighting and Indicators
- 1.4.6 Doors, Door Control and Signal System
- 1.4.7 Heating, Ventilation, and Air Conditioning
- 1.4.8 Communication Systems
- 1.4.9 Propulsion and Electric Braking
- 1.4.10 Friction Brake Equipment
- 1.4.11 Cab Signal and Automatic Train Control
- 1.4.12 Train Monitoring and Data Management
- 1.4.13 Water and Waste Retention Systems.

CHAPTER 2, OPERATING INSTRUCTIONS

This chapter is divided into the following three sections:

Section 2.1, Controls and Indicators

This section briefly describes the functions of all the High-Speed Trainset controls and indicators. Each subsection is dedicated to a major system, in the following order:

- 2.1.1 Carbody, Interior Fixtures, Operating Cab
- 2.1.2 Truck and Suspension
- 2.1.3 Coupler
- 2.1.4 Electrical Distribution System
- 2.1.5 Lighting and Indicators
- 2.1.6 Doors, Door Control and Signal System
- 2.1.7 Heating, Ventilation, and Air Conditioning
- 2.1.8 Communication Systems
- 2.1.9 Propulsion and Electric Braking
- 2.1.10 Friction Brake Equipment
- 2.1.11 Cab Signal and Automatic Train Control
- 2.1.12 Train Monitoring and Data Management
- 2.1.13 Water and Waste Retention Systems.

Section 2.2, Operation

This section provides information related to normal operation of the High-Speed Trainset, in the following order:

- 2.2.1 HEP Operation
- 2.2.2 Preparation for Operation
- 2.2.3 Seat Adjustment
- 2.2.4 Footrest Adjustment
- 2.2.5 Trainset Departure Test
- 2.2.6 Coupling
- 2.2.7 En Route Procedures
- 2.2.8 High Voltage Power - Turning Off and On
- 2.2.9 End of Trip Procedures.

Section 2.3, Emergency Procedures This section provides information related to emergency procedures for the High-Speed Trainset, in the following order:

2.3.1 Fire Extinguisher Operation

2.3.2 Emergency Tools

2.3.3 First Aid Equipment

2.3.4 Opening Windows in an Emergency

2.3.5 Emergency Door Operation

2.3.6 Emergency Braking

2.3.7 Dead Engine Feature

2.3.8 Trainset Evacuation Equipment

2.3.9 Emergency evacuation

2.3.10 Unscheduled Stops

CHAPTER 3, TROUBLESHOOTING PROCEDURES

This chapter includes all the instructions allowing the High-Speed Trainset crew to troubleshoot the equipment.

It lists the symptoms, probable causes and effects, and corrective actions that may be taken as a result of faults or conditions indicated on the Primary Operating Display and Multifunction Displays.

Each troubleshooting table is dedicated to a major system, in the following order:

Section 3.1, Carbody, Interior Fixtures, Operating Cab

Section 3.2, Truck and Suspension

Section 3.3, Coupler

Section 3.4, Electrical Distribution System

Section 3.5, Lighting and Indicators

Section 3.6, Doors, Door Control and Signal System

Section 3.7, Heating, Ventilation, and Air Conditioning

Section 3.8, Communication Systems

Section 3.9, Propulsion and Electric Braking

Section 3.10, Friction Brake Equipment

Section 3.11, Cab Signal and Automatic Train Control

Section 3.12, Train Monitoring and Data Management

Section 3.13, Water and Waste Retention Systems.

CHAPTER 4, CAFE CAR AND GALLEY EQUIPMENT OPERATION

This chapter is devoted to the Cafe Car Operating Instructions. The beverage and food galley operation are also addressed in this chapter.

This chapter is divided into the following three sections:

Section 4.1, Equipment Characteristics Describes the equipment characteristics with views of the equipment showing the general features, essential operating items, and major componentst, in the following order:

- 4.1.1 Cafe Galley
- 4.1.2 Refrigeration System
- 4.1.3 Convection Oven
- 4.1.4 Standard Cart
- 4.1.5 Menu Sign
- 4.1.6 Display Cabinet
- 4.1.7 Beverage Galley
- 4.1.8 Food Galley
- 4.1.9 Crew Office
- 4.1.10 Entertainment System

Section 4.2, Operating Instructions Briefly describes the functions of the Cafe Car and galleys equipment controls and indicators. Provides information related to the normal operation, in the following order:

- 4.2.1 Cafe Galley
- 4.2.2 Microwave Oven
- 4.2.3 Convection Oven
- 4.2.4 Standard Carrier
- 4.2.5 Standard Cart
- 4.2.6 Display Cabinet
- 4.2.7 Coffee Brewer
- 4.2.8 Soft Drinks (Soda System) - Cafe Car.

Section 4.3, Troubleshooting Procedures

Describes cause, effect, and corrective action that may be taken as a result of faults or conditions appearing on the Cafe Car and galleys equipment, in the following order:

4.3.1 Beer System

4.3.2 Soda System

4.3.3 Beverage Galley

4.3.4 Refrigeration System

4.3.5 Convection Oven

INDEX

The index at the end of the manual allows the reader to search through the manual by keywords in alphabetical order. All the systems/subsystems and their major components are listed.

The index is followed by a check list that specifies all the necessary steps to be performed prior to trainset operation.

PAGE NUMBERS

Page numbers are dedicated to major divisions of the manual: The preface is numbered from page A to H, the contents section numbering starts with page i. Chapter 1 starts with page 1-1, and the other chapters follow in the same manner. Figures are identified by chapter and sequence. For example, figure 1-4 is the fourth figure used in chapter 1.

NOTE:

Words with all letters in capitals indicate that the word used in the manual is the same as the label on the equipment.

WARNING PAGES

To prevent physical injury, all personnel directly or indirectly involved with the operation of the trainset are advised to follow the safety instructions listed below:

WARNING:

PERSONNEL ENGAGED IN THE OPERATION OF THE TRAINSET MUST OBSERVE ALL AMTRAK OPERATING RULES AND INSTRUCTIONS APPLICABLE TO THE OPERATION OF HIGH-VOLTAGE EQUIPMENT. FAILURE TO DO SO MAY RESULT IN PERSONAL INJURY, LOSS OF LIFE OR DAMAGE TO PROPERTY.

WARNING:

BEFORE MAKING ANY 480 V POWER JUMPER CONNECTIONS, VERIFY THAT POWER HAS BEEN CUT OFF IN THE TRAINSET OR AT THE SHOP/ WAYSIDE SUPPLY. HANDLE ALL JUMPERS WITH CARE AND IN ACCORDANCE WITH AMTRAK OPERATING RULES AND INSTRUCTIONS.

WARNING:

HIGH VOLTAGES ARE PRESENT THROUGHOUT THE TRAINSET. TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK, ALWAYS EXERCISE EXTREME CARE WHEN WORKING NEAR ELECTRICALLY CHARGED APPARATUS.

WARNING:

FOR THE PROTECTION OF ALL PERSONNEL AROUND OR UNDER TRAINSET, MAKE SURE THE PARKING BRAKES ARE APPLIED OR THAT THE WHEELS ARE CHOCKED. IN THE CASE OF MADE-UP TRAINS, MAKE SURE THE TRAINSET CREW IS AWARE OF PERSONNEL MOVEMENT.

WARNING:

A FALSE PARKING BRAKE APPLY INDICATION CAN OCCUR IF THE PARKING BRAKE IS APPLIED (USING THE PARKING BRAKE SWITCH ON THE ENGINEER'S RIGHT SWITCH PANEL OR THE PARKING BRAKE CUTOUT COCK ON THE BRAKE CONTROL UNIT) AND THE TRUCK MOUNTED PARKING BRAKE MANUAL OVERRIDE LEVER IS PULLED.

WARNING:

WHEN MAKING UP TRAINS, MAKE SURE ALL PERSONNEL IS CLEAR OF TRAIN PRIOR TO MOVEMENT. ALL BLUE SIGNAL PROTECTION AND SAFETY INSTRUCTIONS MUST BE FOLLOWED.

WARNING:

WHENEVER AN INDIVIDUAL HIGH-SPEED TRAINSET CAR HAS TO BE CONNECTED TO ANY OTHER EQUIPMENT, AS IN A YARD MOVE, BOTH THE BRAKE PIPE AND THE MAIN RESERVOIR NEED TO BE CONNECTED TO PROVIDE FUNCTIONAL BRAKES.

WARNING:

IN NORMAL OPERATION, THE TILTING SYSTEM IS CONTROLLED BY THE ACSES SYSTEM. IF THE TRAINSET IS OPERATED WITHOUT A FUNCTIONAL ACSES SYSTEM, STRICT ADHERENCE TO THE PROCEDURE OF DISABLING THE TILTING SYSTEM IN NON-TILT ZONES MUST BE FOLLOWED TO AVOID THE RISKS OF EXCEEDING THE DYNAMIC CLEARANCE.

WARNING:

THE TRAINSET MUST NOT BE OPERATED WHEN THE RED LIFTING CHAINS ARE INSTALLED ON A TRUCK. ALWAYS CHECK THAT THE SERVICE (GRAY) CHAINS ARE IN PLACE PRIOR TO TRAINSET OPERATION.

WARNING:

ALL WARNINGS, CAUTIONS, AND NOTES FOUND THROUGHOUT THIS MANUAL MUST BE FOLLOWED TO MINIMIZE THE RISKS OF PERSONAL INJURY AND EQUIPMENT DAMAGE OR MALFUNCTION. ANYONE WHO USES A SERVICE PROCEDURE THAT IS NOT RECOMMENDED MUST FIRST SATISFY HIMSELF/HERSELF THOROUGHLY THAT NEITHER HIS/HER SAFETY NOR TRAINSET SAFETY WILL BE JEOPARDIZED BY THE METHOD SELECTED.

Warnings, Cautions and Notes are used to highlight or emphasize dangerous or important points in the text. These are presented in three different formats as shown below.

WARNING:

THE WARNING IS USED IN THE CASE OF AN OPERATING OR MAINTENANCE PROCEDURE, PRACTICE, CONDITION, STATEMENT, ETC., WHICH, IF NOT STRICTLY OBSERVED, COULD RESULT IN INJURY OR DEATH.

CAUTION:

The Caution is used in the case of an operating or maintenance procedure, practice, condition, statement, etc., which, if not strictly observed, could result in damage to or destruction of equipment.

NOTE:

The Note is used in the case of an operating or maintenance procedure, practice, condition, statement, etc., which is deemed useful to highlight.

LIST OF REVISIONS

Insert latest change pages and destroy superseded pages. Revision number 0 indicates the original issue. Total number of pages in this Operating Instruction Manual is 428, consisting of:

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DOCUMENT PREPARED BY:

BOMBARDIER
TRANSPORTATION
1101 Parent Street
St-Bruno, Quebec, Canada J3V 6E6
Tel.: (450) 441-2020

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CHAPTER 1
INTRODUCTION

SECTION 1.1
GENERAL INFORMATION

1.1.1 SCOPE. This Operating Instruction Manual provides information regarding operation as well as setup for service, en route, shutdown, and emergency procedures for the high-speed trainset built for Amtrak by the Bombardier Alstom Consortium.

This manual has been prepared to aid the engineer and the train crew in the completion of their duties. The instructions contained herein are not intended to supersede existing Amtrak operating rules and instructions. Whenever there is a conflict, Amtrak rules and instructions shall govern.

All information, illustrations, and specifications supplied are based on the latest product data available at the time of publication. Some minor differences in the trainset equipment may be encountered because of modifications that have been incorporated since the publication of this manual. These changes will be covered in subsequent editions of the manual.

The descriptions and instructions contained in this manual are intended to familiarize operating personnel with the high-speed trainset. This manual also contains sufficient troubleshooting information to identify malfunctioning systems and components.

1.1.2 LIST OF ABBREVIATIONS. The following list details all the abbreviations used in this Operating Instruction Manual.

A/C	Air Conditioning
AAR	Association of American Railroads
ABB	Abbreviation
ABCL	Automatic Brake Control Lever
ac	Alternating Current
ACAP	Attendant Call Annunciation Panel
ACSES	Advanced Civil Speed Enforcement System
ADA	Americans with Disabilities Act
ADU	Aspect Display Unit
AGATE	Advanced GEC Alsthom Traction Electronics
Ah	Amperes per Hour
ARU	Alerter Recorder Control Unit
ATC	Automatic Train Control
ATS	Automatic Train Supervision
ATSCO	Automatic Train Supervision Cutout Switch

BCC	Brake Control Computer
BCU	Brake Control Unit
BCCU	Bistro Communication Control Unit (Cafe Car)
BHDPT	Bulkhead Display Signs Phone-Toilet
BHDTT	Bulkhead Display Signs Toilet-Toilet
BP	Brake Pipe
BRAD	Bistro Radio (Cafe Car)
CB	Circuit Breaker
CCU	Communication Control Unit
CDP	Compact Disk Player
CDPD	Cellular Digital Packet Data
CAN	Controller Area Network
CDU	Cab Display Unit
CFM	Cubic Feet per Minute
CHAN	Channel
CIN	Car Internal Network
CMU	Car Monitoring Unit
dc	Direct Current
DCN	Digital Communication Network
DCS	Door Control System
DISP	Display
DMS	Data Management System
DNRA	Detection of Nonrotating Axle
DTMF	Dual Tone Multifrequency
DVD	Digital Video Disk
EBFS	Emergency Blower Fan Switch
EDR	Extraordinary Data Report
ELD	EMI Limit Detector
EMI	Electromagnetic Interference
EP	Electropneumatic
FCRB	Forced Commutation Rectifier Bridges
ft	Foot/Feet
GID	General Information Display
GTO	Gate Turnoff Thyristor

HEP	Head End Power
HHI	Hand Held Instrument
HST	The Bombardier Alstom Consortium High-Speed Trainset
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IC	Intercom
IDCU	Interior Door Control Unit
IFM	Independent Failure Monitor
in	Inch(es)
INT	Intermittent
ITSS	Integrated Truck Surveillance System
ITSU	Integrated Truck Surveillance Unit
kV	Kilovolt
kW	Kilowatt
lb	Pound(s)
LED	Light-Emitting Diode
LVBC	Low Voltage Battery Charger
LVPS/BC	Low Voltage Power Supply/Battery Charger
LVDN	Low Voltage Distribution Network
MBS	Microprocessor-Based System
MCB	Main Circuit Breaker
MFD1	Multifunction Display No. 1
MFD2	Multifunction Display No. 2
MFDB	Multifunction Display Cafe (Cafe Car)
mph	Miles per Hour
mphps	Miles per Hour per Second
MNET	Monitoring Network
MPU	Main Processing Unit
MR	Main Reservoir
M. U.	Multiple Unit
N	Neutral
PA	Public Address
PBIN	Propulsion and Brake Internal Network
PCU	Passenger Control Unit - Right or Left

PCCU	Power Car Communication Control Unit
PCMCIA	Personal Computer Memory Card Interface Association
PDTL	Presence Detection Trainline
PECU	Propulsion Electronic Control Unit
PIN	Personnel Identification Number
POD	Primary Operating Display
psi	Pound per Square Inch
PTE	Potable Test Equipment
PTT	Push-To-Talk
RAD	Radio
RIOM	Remote Input Output Module
RX	Reception
SCOS	Service Cutout Switch
SLD	Seat Location Display
SS	Speed Sensing
SSCO	Speed Sensing Cutout Switch
TCC	Tilting Car Controller
TMC	Tilting Monitoring Controller
TX	Transmission
Typ.	Typical
UPS	Uninterruptable Power Supply
V	Volt
Vac	Volt, Alternating Current
Vdc	Volt, Direct Current
VOL	Volume
VS	Video System
WSCC	Wheel Slide Control Computer

1.1.3 GLOSSARY. The following glossary provides the meanings of all the specialized terms used in this Operating Instruction Manual.

TERM	ABB	DESCRIPTION
Advanced Civil Speed Enforcement System	ACSES	Vigilance system enforcing additional speed limitations and complete stop, in complement to the actual Cab Signal/ATC system.
Automatic Brake Control Lever	ABCL	Allows automatic electronic control, with pneumatic backup, of the brake system by the engineer.
Auxiliary Block	-	This is the smaller equipment box located in the equipment room. It contains all the auxiliary systems control apparatus and some of the power control system equipment shown on Figure 1-16.
Cab Display Unit	CDU	Cab Console screens and processors providing the primary visual interface to the power car and its subsystems.
Car Internal Network	CIN	Communication module between the computer-controlled systems, the car monitoring unit, and the cab display unit.
Car Monitoring Unit	CMU	Computer managing the power car network information and monitoring information through the data management system.
Central Block (Motor Block)	-	This is the bigger equipment box located in the equipment room. It contains all the traction power control system apparatus shown on Figure 1-15.
Controller Area Network	CAN	Communication module between the brake control levers and the brake control computer/independent failure monitor.
Data Management System	DMS	Management computer that enables transfer from train data system to wayside facilities.
Detection of Nonrotating Axle	DNRA	Monitors the movement of each truck axle in conjunction with the brake control computer.
Digital Communication Network	DCN	This network is a redundant E1 digital link and is categorized as a Time Division Multiplexing network.
Dual Tone Multifrequency	DTMF	Dispatch call tones transmitted by the remote control head.

TERM	ABB	DESCRIPTION
EMI Limit Detector	ELD	Detects the electromagnetic interferences and protects the power car vital systems against a too high level of electromagnetic wave emission.
Extraordinary Data Report	EDR	Displays information on maintenance event on the MFD2.
Gate Turnoff Thyristor	GTO	A bistable semiconductor device comprising three or more junctions that can be switched from the OFF state to the ON state, or vice versa, by application of a small electric signal.
Independent Failure Monitor	IFM	Vigilance system that monitors the brake system by comparing the total brake demand and the calculated brake effort.
Integrated Truck Surveillance System/Unit	ITSS/ ITSU	Electronic watchdog monitoring each truck for hot bearings and truck hunting. It displays an alarm on POD when the monitored information is outside normal operating range.
Leaky Feeder	-	Antenna that allows communication between the wayside and the trainset walkie-talkies through a radio in the cafe car.
Light-Emitting Diode	LED	A semiconductor diode that emits light when a voltage is applied to it.
Microprocessor-Based System	MBS	System (and/or subsystem) controlled by microprocessor (computer chip).
Multifunction Display	MFD	Operating and/or maintenance screen used by the engineer and/or the assistant and maintenance personnel. Display operational values and statuses.
Remote Input Output Module	RIOM	Programmable controller that interfaces between switching components (relays, contactors, switches, breakers) and the AGATEs
Primary Operating Display	POD	Main operating screen for the engineer, that displays speed, speed limits, time, cruise control setting, and alarms.
Main Processing Unit	MPU	Main computer of the propulsion system.
Propulsion Electronic Control Unit	PECU	Controls electrical energy supply from the catenary to the four motor inverters.
Traction Electronics	-	Controls the propulsion electronic control unit.

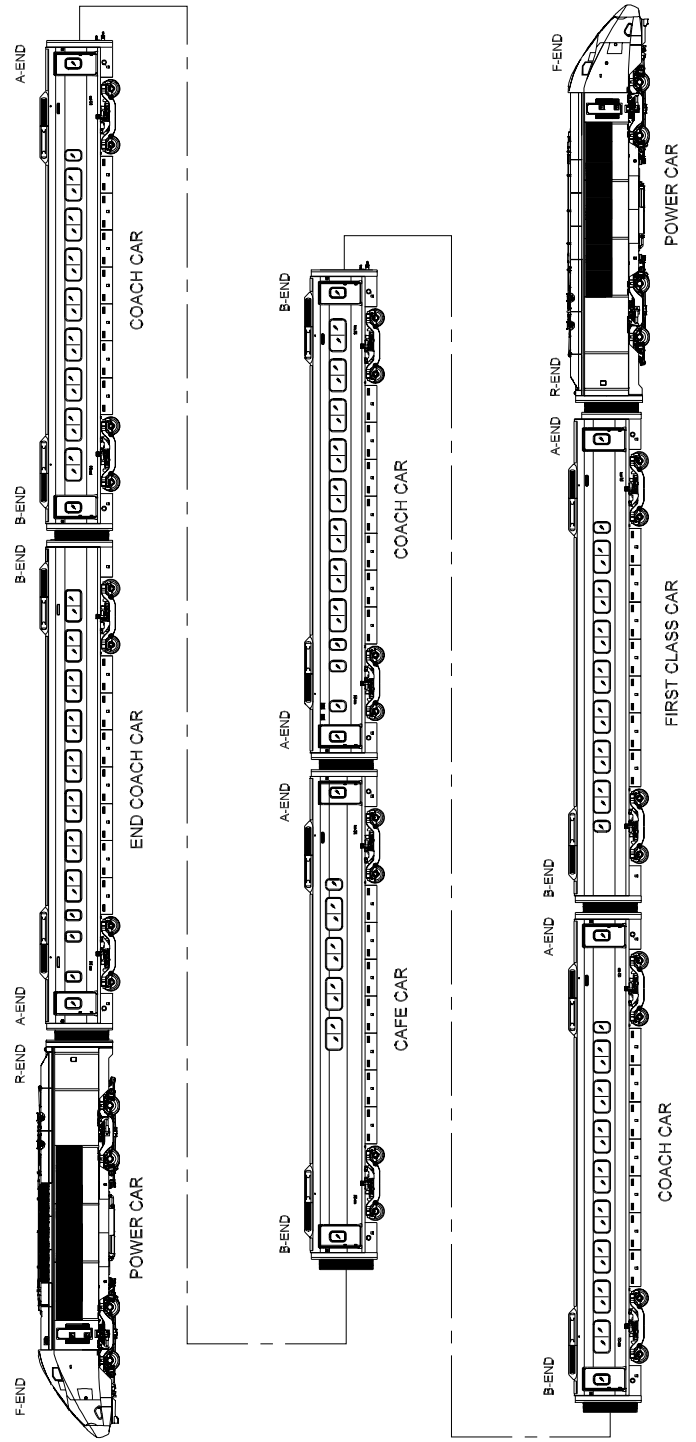


Figure 1-1
High-Speed Trainset - Typical 1-6-1 Configuration

SECTION 1.2
EQUIPMENT DESCRIPTION

1.2.1 EQUIPMENT CHARACTERISTICS. The Bombardier Alstom Consortium high-speed trainset is shown in Figure 1-1. The typical configuration of the trainset is 1-6-1, One power car, six passenger cars, and another power car coupled in the following order: Leading power car, one end coach car, one coach car, one cafe car, two coach cars, one first class car, trailing power car. A consist can also be made up of two trainsets, for a 1-6-1-1-6-1 configuration. Up to four additional coaches can also be added, to form a 1-10-1 configuration.

1.2.2 TRAINSET DATA.

Type ..... High-Speed Electric Trainset

Train Consist: ..... 2 power cars and 6 Passenger Cars

Propulsion System: ..... Continuous 4,600 kW/6,000 HP per power car

Motors: ..... 4 asynchronous AC traction motors per power car

Traction Control: ..... GTO-Type inverters, water cooled

Transmission: ..... Fully truck suspended gear box and motor assembly

Operating Speed: ..... 150 mph

Maximum speed design: ..... 165 mph

Starting tractive force: ..... 49,400 lb

Braking distance at service rate: ..... 10,400 ft

Emergency braking distance: ..... 8,840 ft

Minimum radius of horizontal curve: ..... 250 ft

Minimum radius of vertical curve: ..... 2,000 ft

Buff Load at anti-climber: ..... 800,000 lb

Number of passengers per trainset: 304

Wheelchair locations: 5

Trainset total weight: ..... 1,171,000 lb

Trainset Length Over Pulling Faces: ..... 663 ft 8-3/4 in

Car Numbers:

Power car: ..... 2000 to 2039

First class car: ..... 3200 to 3219

Cafe car: ..... 3300 to 3319

End coach car: ..... 3400 to 3419

Coach car: ..... 3500 to 3559

1.2.2.1 Power Car Data.

Model Designation: ..... Power Car (PC)

Type: ..... Electric - 1 Cab

Transformer (Silicone Oil Cooled)
Primary Voltages: ..... 12 kV/25 Hz - 12.5 kV/60 Hz - 25 kV/60 Hz

Rectifier (Glycol Cooled): ..... GTO Forced commutated rectifier

Continuous Rating: ..... 4,600 kW

HP Equivalent: ..... 6,169 HP

Traction Motors (4 Total)
Model: 4-FXA-4559C
Type: ..... 3 Phase, 4 Pole, Induction Asynchronous AC
Maximum Tractive Effort (Starting Effort): ..... 12,375 lbf
Current Rating Maximum Continuous: ..... 520 A
Current Rating Maximum During Acceleration: ..... 690 A

Driving Wheels (4 Pairs)
Diameter (New): ..... 40 in
Gear Ratio: ..... 71/23 (3.08: 1, Wheel/Motor
Maximum speed: ..... 150 mph

Auxiliary Power & HEP Rating: ..... 3-Phase, 480 V, 60 Hz, 1000 kW

Pantograph (2 Total) Type: ..... Single-Arm

Air Compressor Capacity ..... 120 cubic feet per minute

Main Reservoir Capacity: ..... 60,390 cubic in. (3 x 20,130 cubic in.)

Brake Supply Reservoirs Capacity: ..... 12,200 cubic in. (2 x 6100)

Auxiliary Reservoir Capacity: ..... 3,660 cubic inches.

Storage Battery
Type: ..... Nickel Cadmium
Number of Cells: 50
Voltage: ..... 72 Vdc Nominal
Rating (8-hour): ..... 235 Ah

Sand: ..... 2.5 ft cu. each box (4 total, 2 on each end)

Air Brakes: ..... 20SL Compatible

Weight on Drivers
Maximum: ..... 200,000 lb
Maximum Per Axle: ..... 50,750 lb
On Drivers: 100%

Major Dimensions
Length Over Pulling Faces:.....69 ft 7-3/8 in.
Rail to Roof Height:.....14 ft 2 in.
Width (Over Side Sheets):.....10 ft 5 in.
Truck Wheel Base:.....9 ft 4 in. (112 in.)
Truck Centers:.....35 ft 3 in. (423 in.)
Coupler Height Above Rail:..... 34-1/2 in.
Height Over Fully Extended Pantograph:(Greater Than) > 24 ft 6 in. Up to 25 ft 2 in.

HVAC
Heating Capacity:..... 6.8 kW
Air Conditioning Capacity:.....1.5 Tons
Refrigerant:.....R134A
Air Flow:.....500 cfm
Cab Heaters:..... 7 kW.

1.2.2.2 Passenger Cars Data.

Model Designation
End Coach Car:..... (EC)
Coach Car:.....(CO)
Cafe Car:.....(CO)
First Class Car:..... (FC)

Length Over Pulling Faces:.....87 ft 5 in.

Width Over Side Sheets:.....10 ft 4-1/2 in.

Rail to Roof Height:.....13 ft 10-5/8 in.

Floor Height Above Rail.....4 ft 3 in. (51 in.)

Width (Interior, Floor Level):.....8 ft 11 in. (107 in.)

High Ceiling Height:.....7 ft 1 in. (85 in.)

Low Ceiling Height:.....6 ft 7 in. (79 in.)

Aisle Width:..... 2 ft (24 in.)

Truck Wheel Base:.....9 ft 10 in. (118 in.)

Truck Centers:.....59 ft 6 in.

Wheel Diameter (4 Pairs):.....36 in

Max. Tilting Angle:..... 3.2^{o}

NOTE:

The maximum tilting angle is based on clearance considerations associated to the carbody geometry. The tilting system compensates the lateral accelerations induced by cant deficiency in curves. The maximum compensation goes up to 39.5% of the deficiency at speeds of 45 mph or more. The maximum cant deficiency is 9 inches or 8.53 degrees, 37.5% of 8.53 degrees is 3.2^{o}.

Seats
End Coach Car:.....65
Coach Car:.....65
Cafe Car:.....0
First Class Car: 44

Weight
End Coach Car:.....129,000 lb
Coach Car:.....127,000 lb
Cafe Car:.....132,000 lb
First Class Car: .....129,000 lb

Maximum Weight per Axle: .....35,750 lb

Side Door Width ..... 3 ft (36 in.)

Body End Door Width..... 2 ft 8-1/2 in (32-1/2) in.

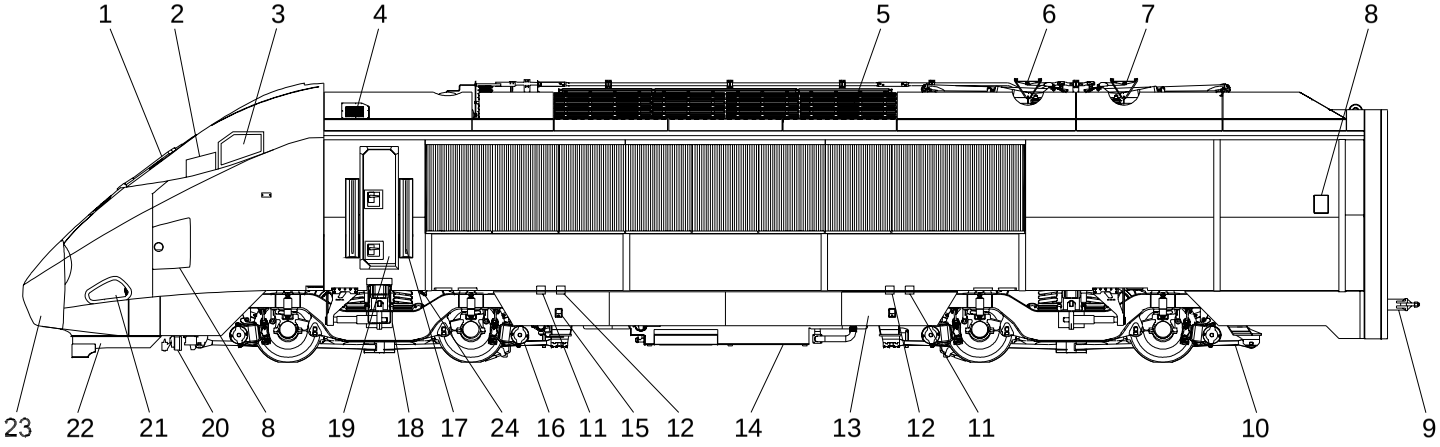
Collision Post Door Width .....3 ft 7 in. (43 in.)

HVAC
Heating Capacity..... 75 kW
Air Conditioning Capacity.....14 Tons
Refrigerant R22
Air Flow .....3,500 cfm

1.2.3 LOCATION OF MAJOR COMPONENTS (Fig. 1-2 to 1-34). The following external and internal views of the equipment show the high-speed trainset general features, essential operating items, and major components and accessories.

NOTE:

Only the information pertaining to the operating crew is included.



F-END

AB000010

1. Windshield
2. Retractable Mirror
3. Side Window
4. Air Inlet Grille
5. Air Intake Grille
6. Front Pantograph
7. Rear Pantograph
8. Sandbox Access Door
9. Drawbar
10. Rear End Truck
11. Brake Applied Red Indicator
12. Parking Brake Applied Gold Indicator
13. Access to Wheelslip/Slide Module, Truck Equipment Cutout Cock, Water System Snoot
14. Main Transformer
15. Access to Wheelslip/Slide Module, Truck Equipment Cutout Cock, Water Fill Station
16. Front End Truck
17. Grab Handle
18. Ladder
19. Entrance Door
20. Track Receiver
21. Ditch Light
22. Pilot
23. Shroud
24. Ground Light

R-END

Figure 1-2
Power Car Exterior Equipment - Left Side

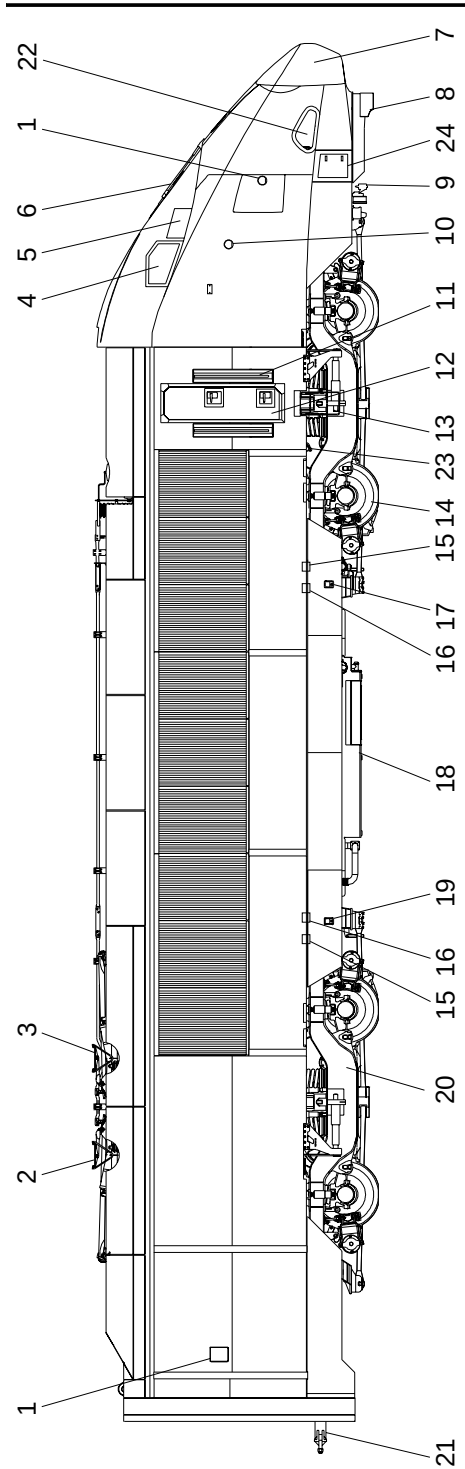
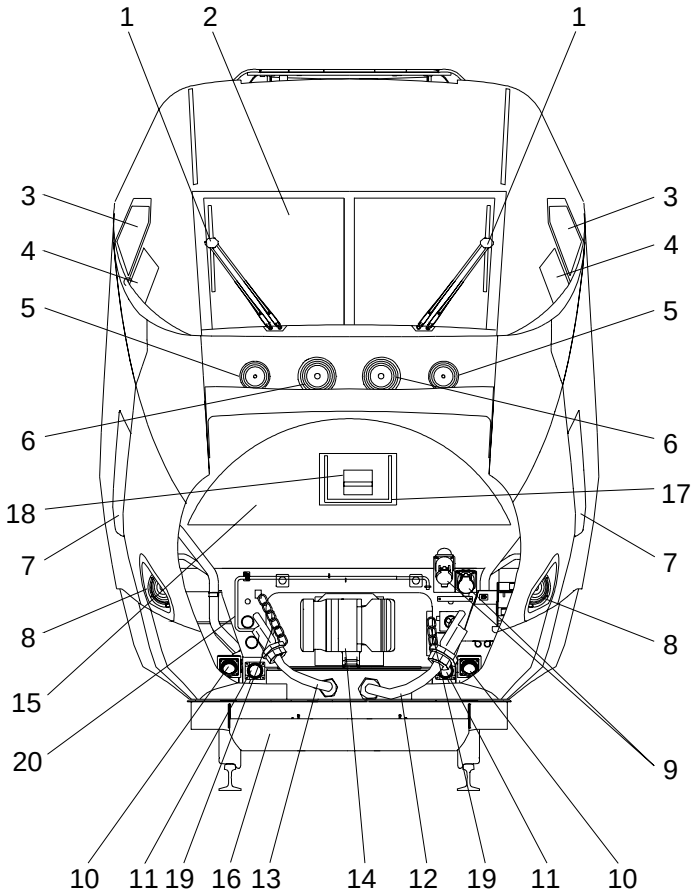


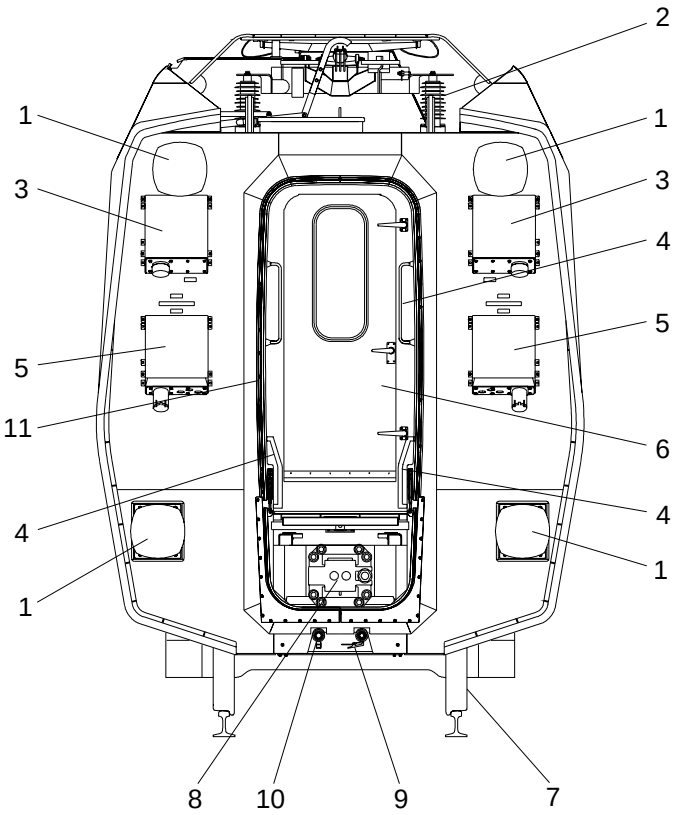
Figure 1-3
Power Car Exterior Equipment -Right Side



1. Windshield Wiper
2. Windshield
3. Cab Side Window
4. Retractable Mirror
5. Marker Light
6. Headlight
7. Sandbox Access Door
8. Ditch Light
9. 480 V Trainline Receptacle
10. Train Control and Communication Trainline Receptacle
11. Dummy Receptacle
12. Main Reservoir/Equalizing Pipe
13. Brake Pipe
14. Coupler
15. Shroud (in Open Position)
16. Pilot
17. Shroud Opening Handle
18. Shroud Unlocking Lever
19. Safety Chain with Glad Hand
20. Uncoupling Mechanism (Cutting Lever)

AB000028

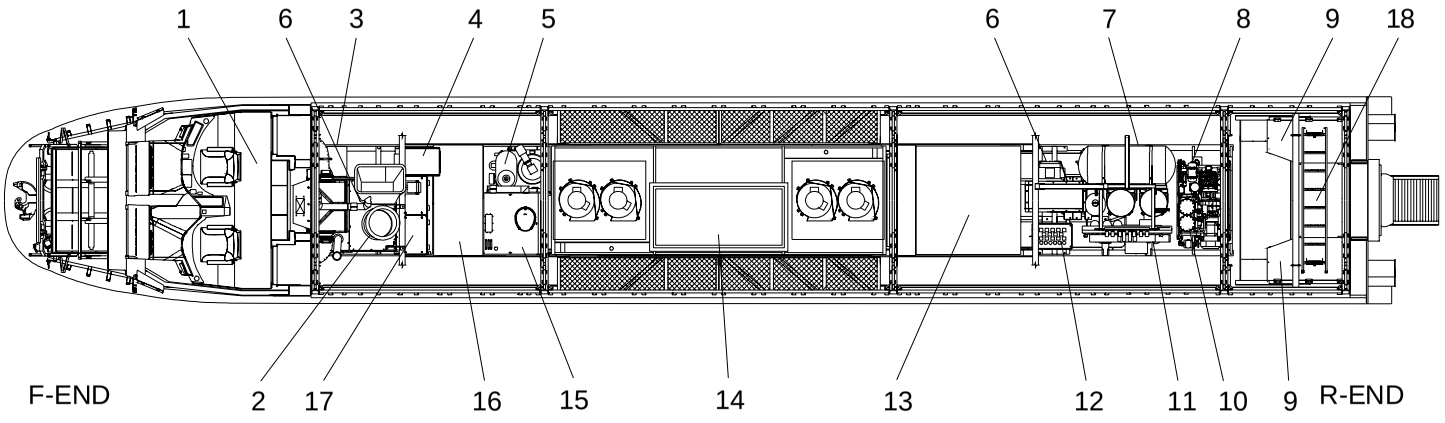
Figure 1-4
Power Car Exterior Equipment - Front End



1. Energy Absorber
2. Rear Pantograph
3. Train Control and Communication Trainline Receptacle
4. Grab Handle
5. 480 V Trainline Receptacle
6. Rear End Door
7. Rear End Truck
8. Drawbar
9. Brake Pipe
10. Main Reservoir/Equalizing Pipe
11. Gangway

AB000027

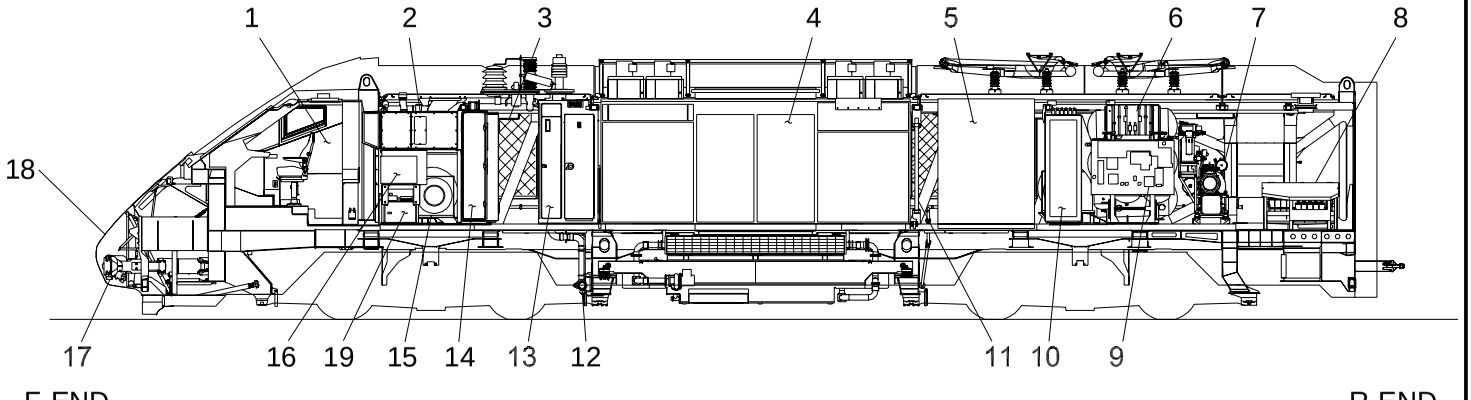
Figure 1-5
Power Car Equipment - Rear End



AB000015

1. Power Car Cab
2. HVAC Unit
3. Crew Locker
4. Electrical Locker No. 2
5. Tap Changer
6. Traction Motor Blower
7. Main Reservoir
8. Auxiliary Air Compressor
9. Battery Rack
10. Air Compressor and Dryer
11. Brake Control Unit and Pantograph Pneumatic Control Panel
12. Propulsion Electrical Cubicle
13. Auxiliary Block
14. Central Block (Motor Block)
15. Toilet Module
16. Transverse Aisle
17. Electrical Locker No. 1 and No. 3
18. Roof Access Hatch Ladder

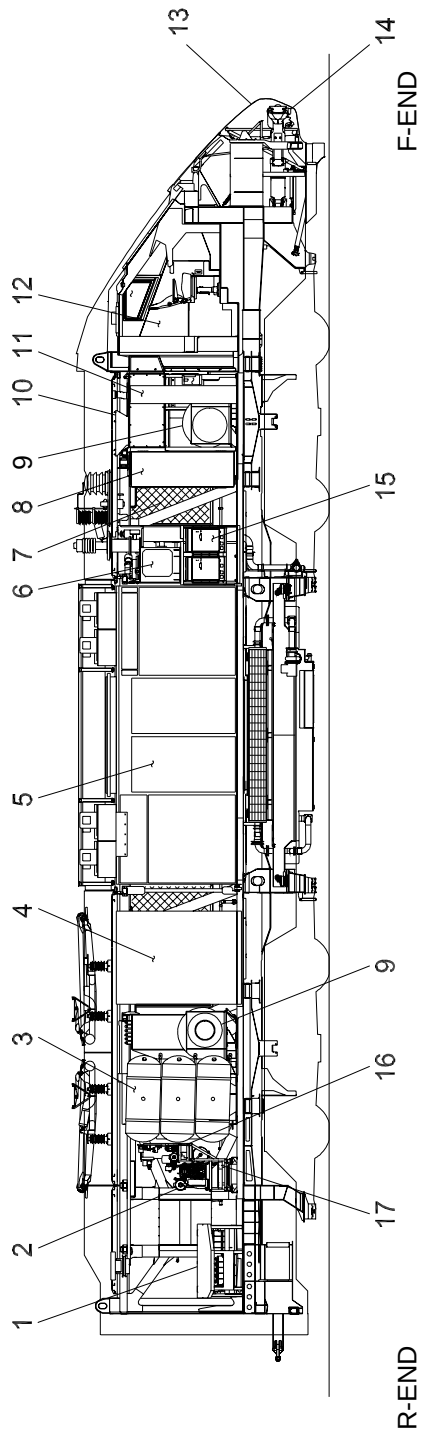
Figure 1-6
Power Car Interior Arrangement - Top View



1. Power Car Cab
2. HVAC Unit
3. Transverse Aisle
4. Central Block (Motor Block)
5. Auxiliary Block
6. Pantograph Pneumatic Control Panel
7. Air Compressor and Dryer
8. Battery Rack
9. Brake Control Unit
10. Propulsion Electrical Cubicle
11. Pantograph Pole
12. Toilet Module
13. Toilet Module Front Access Panel
14. Electrical Locker
15. Traction Motor Blower
16. ATS/ATC Equipment Cabinet
17. Coupler
18. Shroud
19. ACSES Equipment Cabinet

AB270001

Figure 1-7
Power Car Interior Arrangement - Left Side



1. Battery Rack
2. Air Supply Unit/Compressor
3. Main Reservoir
4. Auxiliary Block
5. Central Block (Motor Block)
6. Tap Changer
7. Transverse Aisle
8. Electrical Locker No. 2, with EMI Limit Detector and Alerter Recorder Control Unit
9. Traction Motor Blower
10. HVAC Unit
11. Crew Locker
12. Power Car Cab
13. Shroud
14. Coupler
15. Low Voltage Battery Charger
16. Auxiliary Compressor
17. Conductor's Emergency Brake Valve and Emergency Magnet Valve Cutout Cock

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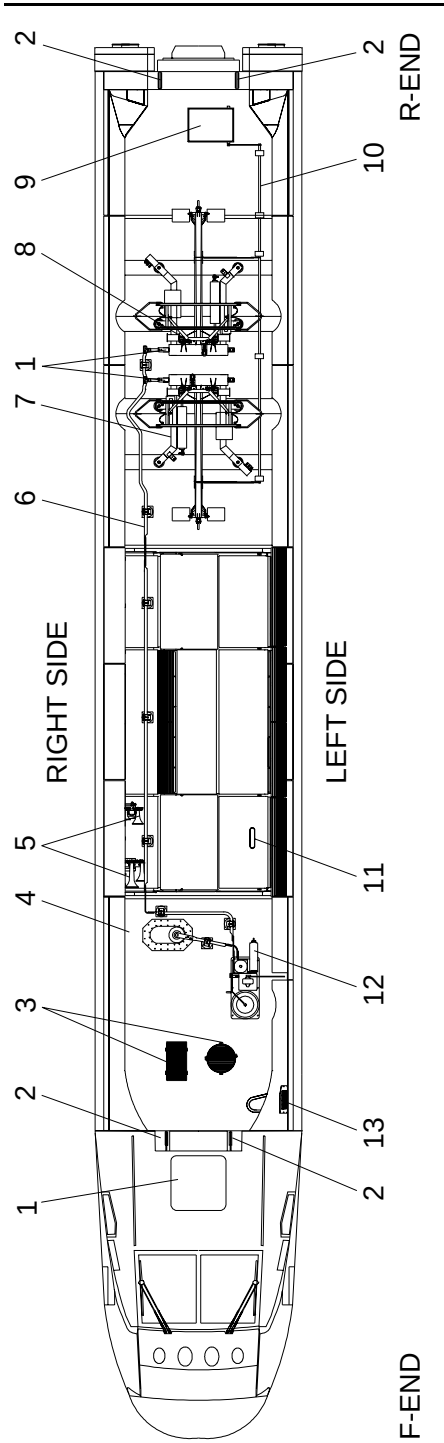
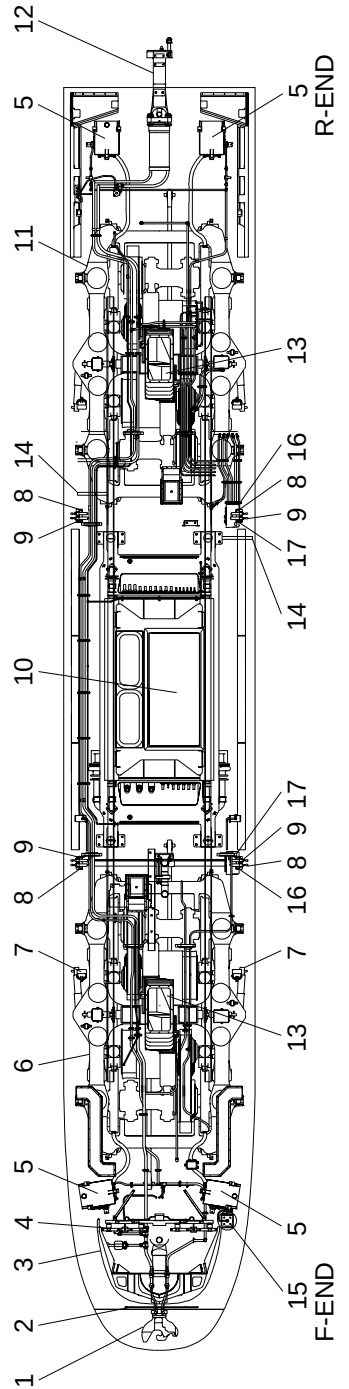
Figure 1-8
Power Car Interior Arrangement - Right Side



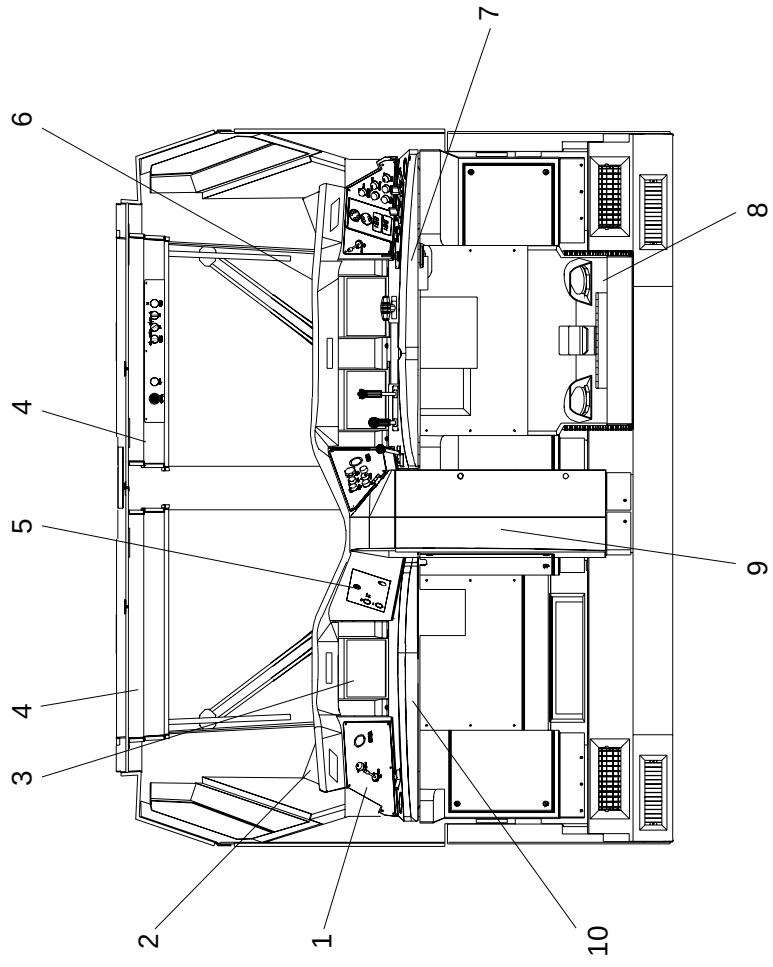
1. Soft Spot for Emergency Access to Cab Area
2. Lifting Hook
3. Condenser Grilles
4. Tap Changer
5. Horns
6. High Tension Bar
7. Front Pantograph
8. Rear Pantograph
9. Roof Access Hatch
10. Pantographs Locking Device
11. Radio Antenna
12. Four-Function Unit (Main Circuit Breaker, Grounding Switch, Lighting Arrestor, Catenary Voltage Sensing Transformer
13. Fresh Air Grille

Figure 1-9
Power Car Roof Equipment



1. Coupler
2. Shroud
3. Pilot
4. Track Receiver
5. Sandbox
6. Front End Truck
7. Ground Light
8. Brake Applied Red Indicator
9. Parking Brake Applied Gold Indicator
10. Main Transformer
11. Rear End Truck
12. Drawbar
13. Traction Motor Ventilation Duct
14. Fire Extinction System - Water System Snoot
15. Bell
16. Truck Equipment Cutout Cock
17. Wheelslip/Slide Module (Dump Valve Module)

Figure 1-10
Power Car Underfloor Equipment



1. Assistant's Left Switch Panel
2. Assistant's Console
3. Multifunction Display No. 2 (MFD2)
4. Sun Visor
5. Assistant's Headset Station
6. Engineer's Console
7. Engineer's Desk
8. Adjustable Footrest
9. Center Console
10. Assistant's Desk

AB000041

Figure 1-11
Power Car Cab Console General Arrangement

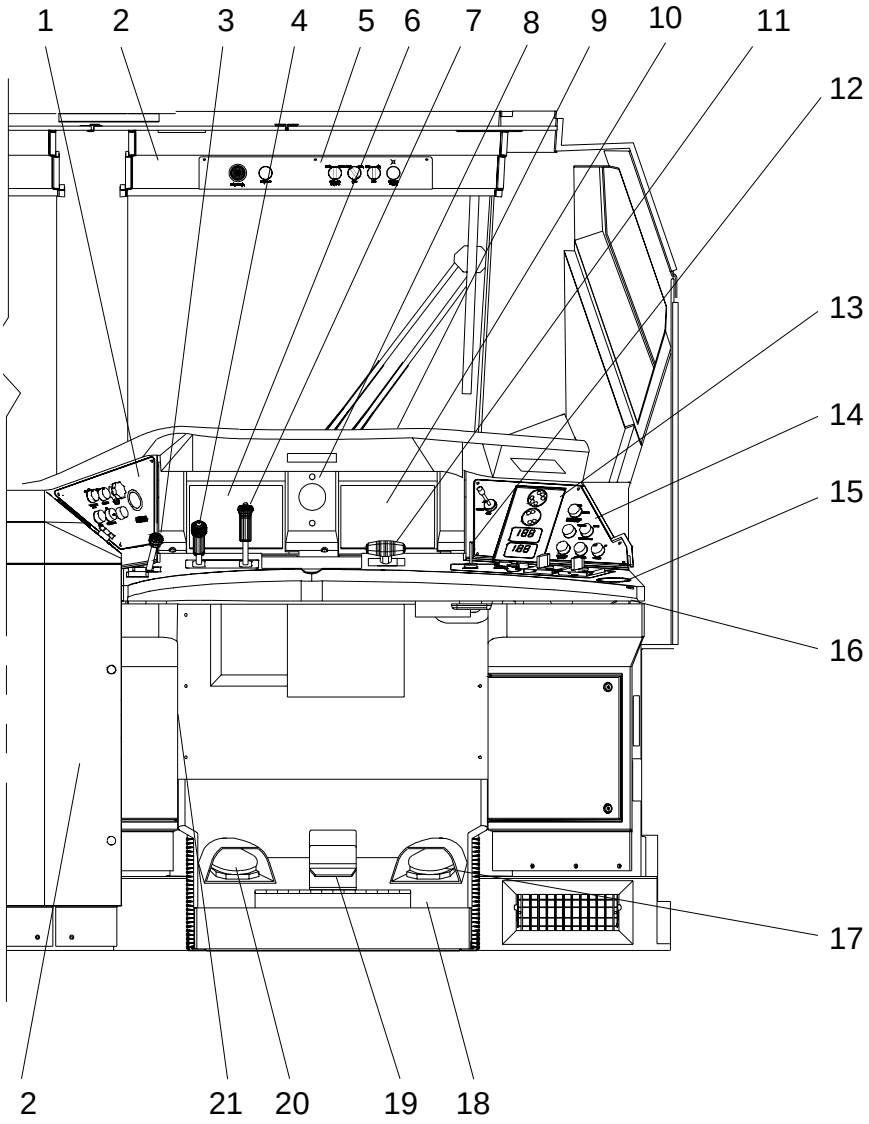
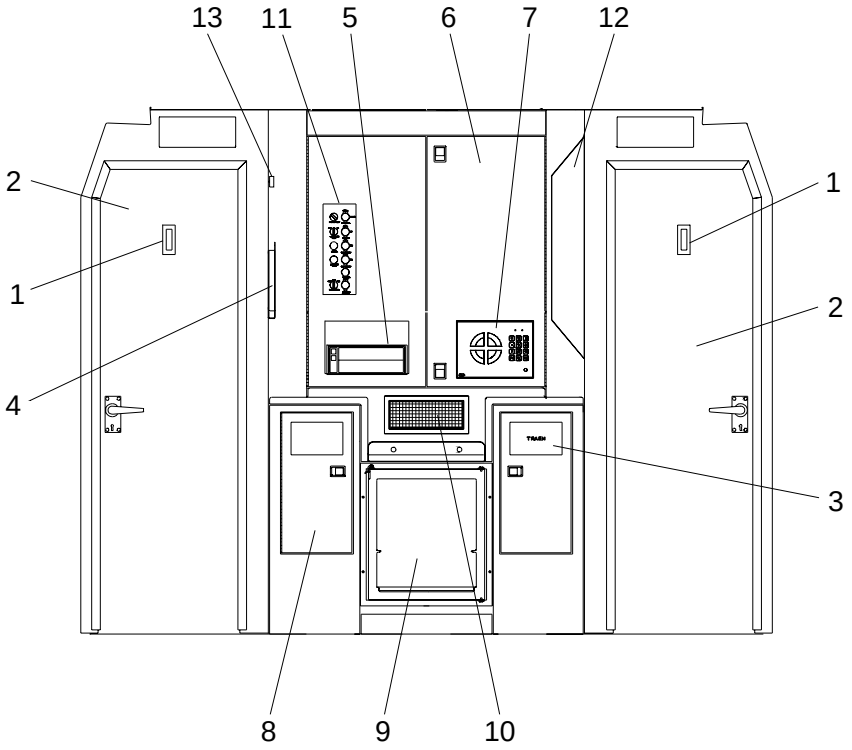


Figure 1-12
Engineer's Console Equipment Layout

Legend for Figure 1-12

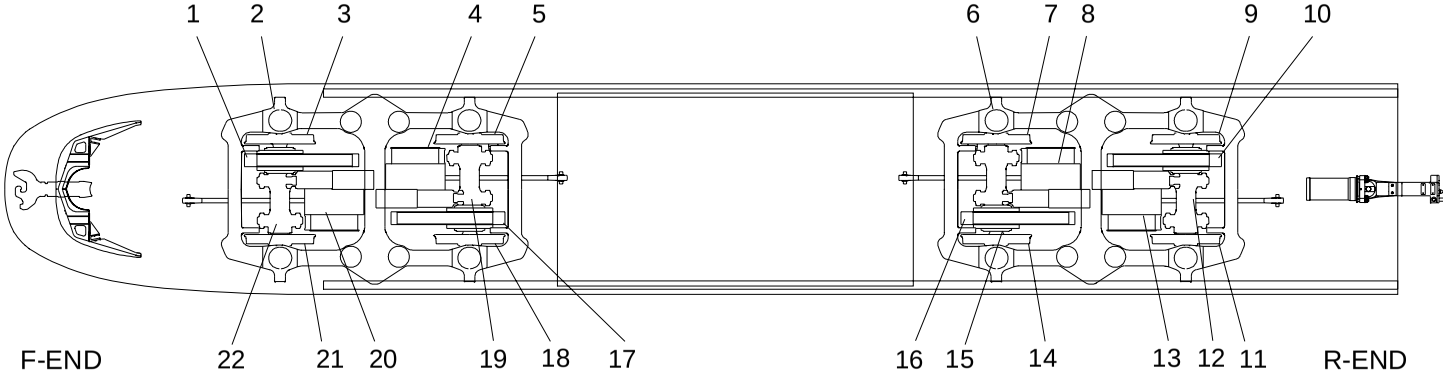
1. Engineer’s Left Switch Panel
2. Sun Visor
3. Reverser
4. Cruise Control Lever
5. Engineer’s Overhead Switch Panel
6. Multifunction Display No. 1 (MFD1)
7. Propulsion Throttle Control Lever
8. Engineer’s Microphone
9. Engineer’s Console
10. Primary Operating Display (POD)
11. Automatic Brake Control Lever
12. Acknowledge Switch
13. Aspect Display Unit
14. Engineer’s Right Switch Panel
15. Engineer’s Desk Right Switch Panel
16. Engineer’s Desk
17. Horn Footswitch
18. Adjustable Footrest
19. Acknowledge Footswitch
20. Communication Footswitch
21. Adjustable Footrest Switch Panel, with PTE Connectors
22. Engineer’s Center Console Switch Panel, with Remote Control Head



AB000031

1. Coat Hook
2. Cab Door
3. Trash Receptacle
4. Train Order Holder
5. Cab Printer
6. HVAC Blower Fan Access Panel
7. Key Card Reader
8. Fire Extinguisher Compartment
9. Refrigerator, with Seat Cushion (Supervisor Seat) on Top
10. Air Vent
11. Cab Rear Wall Switch Panel
12. Emergency Equipment (First Aid Kit) and Tool Box (Adjustable Wrench and Pinch Bar)
13. Cab Heat Temperature Sensor

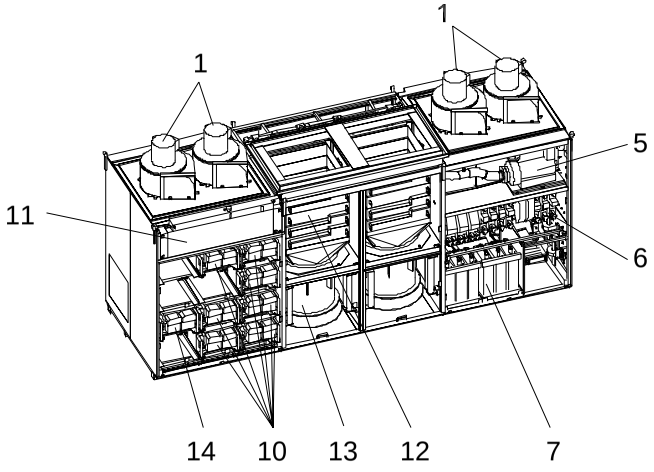
Figure 1-13
Power Car Cab Wall Equipment Layout



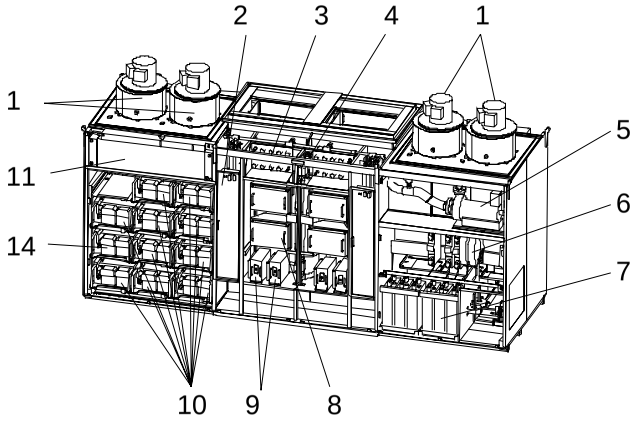
1. ACSES and Wheelslip/ Brakes Speed Sensors
2. F-End Truck
3. Wheel No. R1
4. Traction Motor No. 2 Speed Sensor
5. Wheel No. R2
6. R-End Truck
7. Wheel No. R3
8. Traction Motor No. 3 Speed Sensor
9. Wheel No. R4
10. ACSES and Wheelslip/ Brakes Speed Sensors
11. Wheel No. L4
12. Axle No. 4
13. Traction Motor No. 4 Speed Sensor
14. Wheel No. L3
15. Axle No. 3
16. ATC and Wheelslip/Brakes Speed Sensors
17. ATC and Wheelslip/Brakes Speed Sensors
18. Wheel No. L2
19. Axle No. 2
20. Traction Motor No. 1 Speed Sensor
21. Wheel No. L1
22. Axle No. 1

AB000040

Figure 1-14
Power Car Trucks, Wheels and Speed Sensors Arrangement (Top View)



LEFT SIDE



RIGHT SIDE

1. Central Block Blower
2. Access Panel to Sensors, Relays, Contactors, and Knife Switches
3. Low Voltage Connectors for: AGATE/MPU, Master Controller, Speed and Current Sensors, Fire Suppression Equipment, Control Electronics
4. Fire Suppression FE13 Extinguishing Agent High-Pressure Container
5. Cooling Liquid (Glycol/Water) Pump
6. Power Converters Isolation Switches and Contactors
7. Filtering Capacitors (Condenser Banks)
8. AGATE Control Modules
9. Power Supply
10. Power Modules, Main Components of Rectifiers (FCRB) and Inverters
11. Liquid Cooling Radiator
12. Rheostatic Brake Resistor
13. Rheostatic Brake and Main Transformer Blower
14. Rheostatic Brake Power Module

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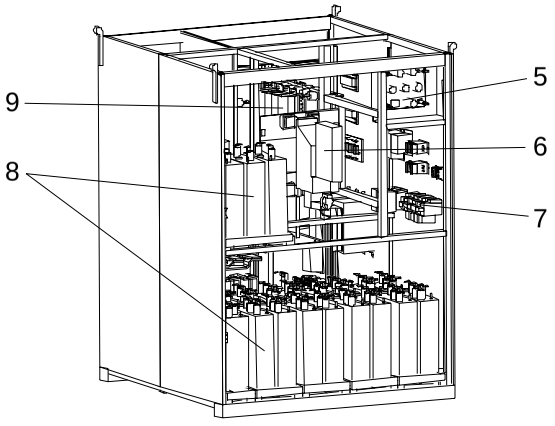
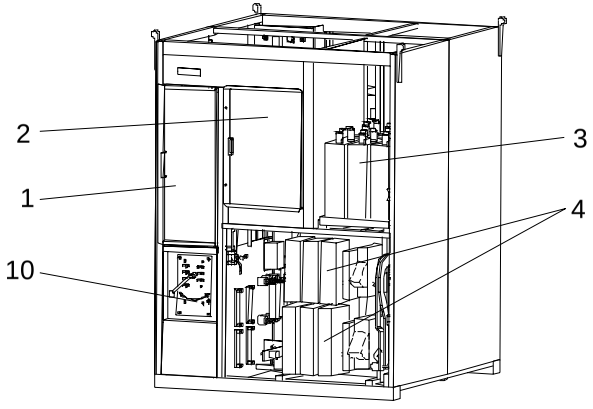
Figure 1-15
Power Car Central Block Equipment Arrangement



LEFT SIDE



RIGHT SIDE

1. Auxiliary Block Circuit Breaker Panel
2. 4000 Volt LED Display
3. Auxiliary Filtering Capacitors (Condenser Banks)
4. Auxiliary Circuits Power Supply Contactors
5. Low Voltage Connectors for:
   72 Vdc Power Supply, AGATE/MPU, Current Sensors,
   Fire Suppression System and Control Electronics, Trainlines
6. Selection Contactor of 50/120 Hz Filter for 2F Filter
7. Auxiliary Control Contactors
8. Main Filter and Condenser Banks
9. Power Resistors and Sensors
10. Auxiliary Block Key Switch

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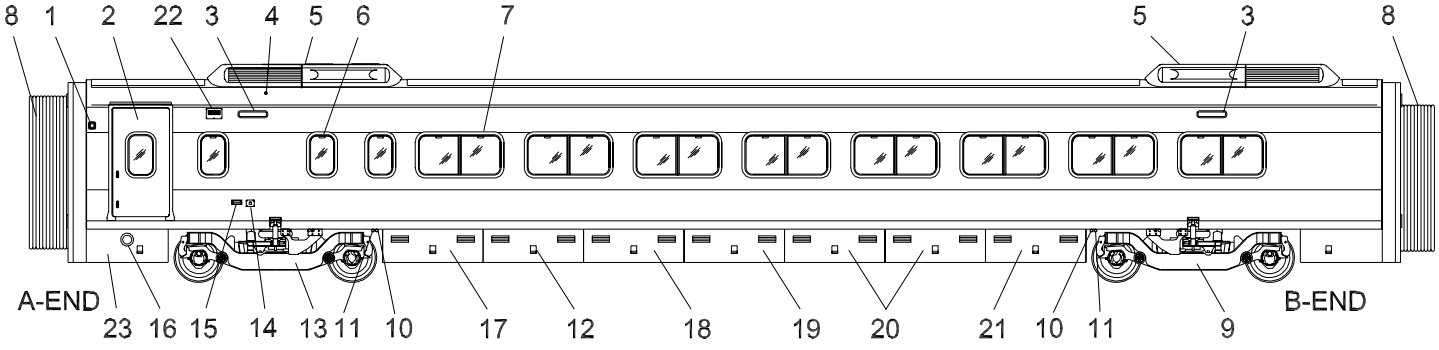
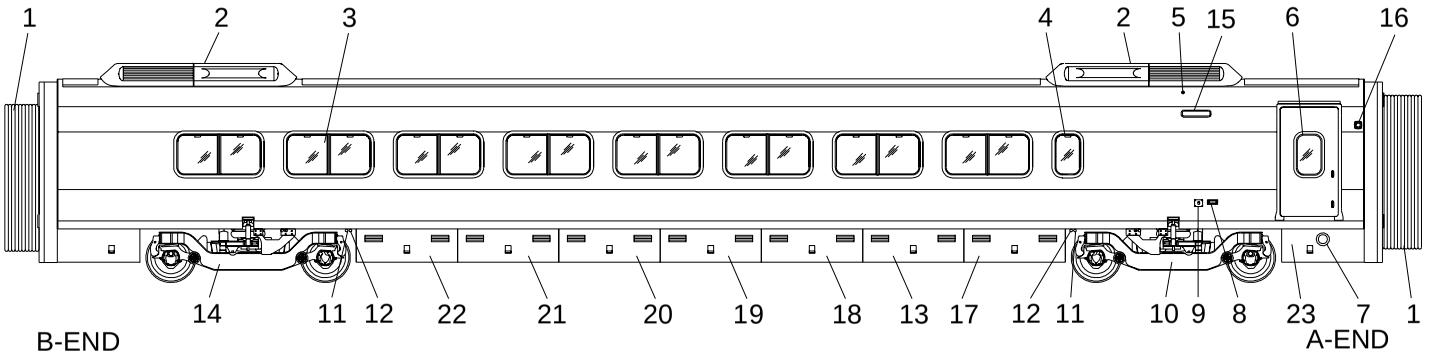
Figure 1-16
Power Car Auxiliary Block Equipment Arrangement



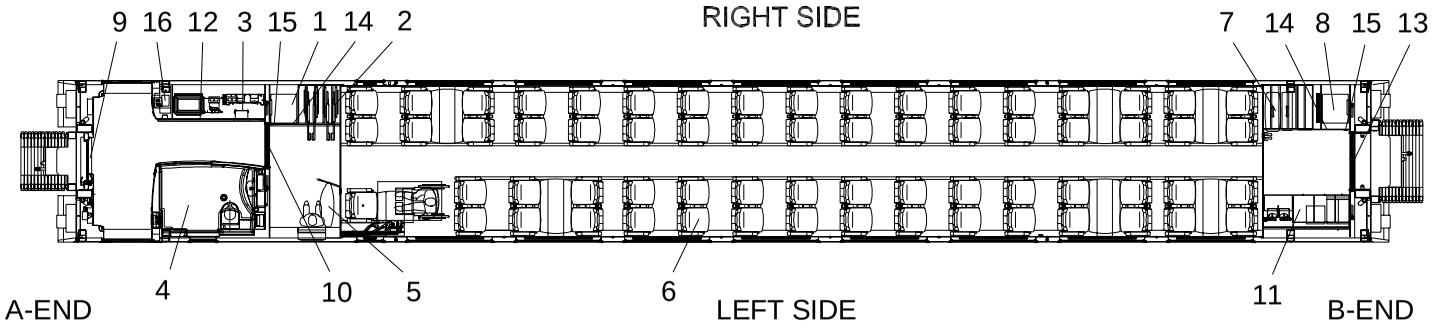
1. Exterior Speaker
2. Side Door
3. Exterior Display Sign
4. Door Open Red Indicator
5. HVAC Unit
6. Small Emergency Window
7. Large Emergency Window
8. Diaphragm
9. B-End Truck
10. Brake Applied Red Indicator
11. Parking Brake Applied Gold Indicator
12. Side Skirt/Access to Waste Tank
13. A-End Truck
14. Exterior Crew Key Switch
15. Exterior Emergency Door Release Handle, with Emergency Rescue Station
16. Exterior Ground Light
17. Side Skirt/Access to Dump Valve, 480 V Junction Box, Truck Brake Equipment Cutout Cock
18. Side Skirt/Access to Water Filling Valve, Water Reservoir, Water Raising Unit
19. Side Skirt/Access to LVPS, Battery Charger
20. Side Skirt/Access to Batteries
21. Side Skirt/Access to Truck Brake Equipment Cutout Cock, Brake Control Unit, Air Reservoir
22. Air Vent
23. Access Panel to Folding Stairs

Figure 1-17
End Coach Car Exterior Arrangement - Left Side



1. Diaphragm
2. HVAC Unit
3. Large Emergency Window
4. Small Emergency Window
5. Door Open Red Indicator
6. Side Door
7. Exterior Ground Light
8. Exterior Emergency Door Release Handle, with Emergency Rescue Station
9. Exterior Crew Key Switch
10. A-End Truck
11. Parking Brake Applied Gold Indicator
12. Brake Applied Red Indicator
13. Side Skirt/Access to Waste Service Line, Waste Tank
14. B-End Truck
15. Exterior Display Sign
16. Exterior Speaker
17. Side Skirt/Access to Tilting Manifold, 480 V Junction Box
18. Side Skirt/Access to Water Reservoir, Water Filling Valve
19. Side Skirt/Access to Tilting Hydraulic Power Supply
20. Side Skirt
21. Side Skirt/Access to Transformer, Water Separator
22. Side Skirt/Access to Tilting Manifold, Air Reservoir
23. Access Panel to Folding Stairs

Figure 1-18
End Coach Car Exterior Arrangement - Right Side



1. A-End Trash Compartment
2. A-End Luggage Tower
3. Emergency Equipment Location
4. ADA Toilet Room
5. Telecom Center
6. Seat
7. B-End Luggage Tower
8. B-End Trash Compartment
9. Front End Door
10. Body End Door
11. Beverage Galley
12. Electrical Locker
13. Collision Post Door
14. Conductor's Emergency Brake Valve, and Truck Brake Equipment Cutout Cock
15. Emergency Blower Fan Switch, with HVAC and Door PTE Connectors
16. Water Fountain with Cooler

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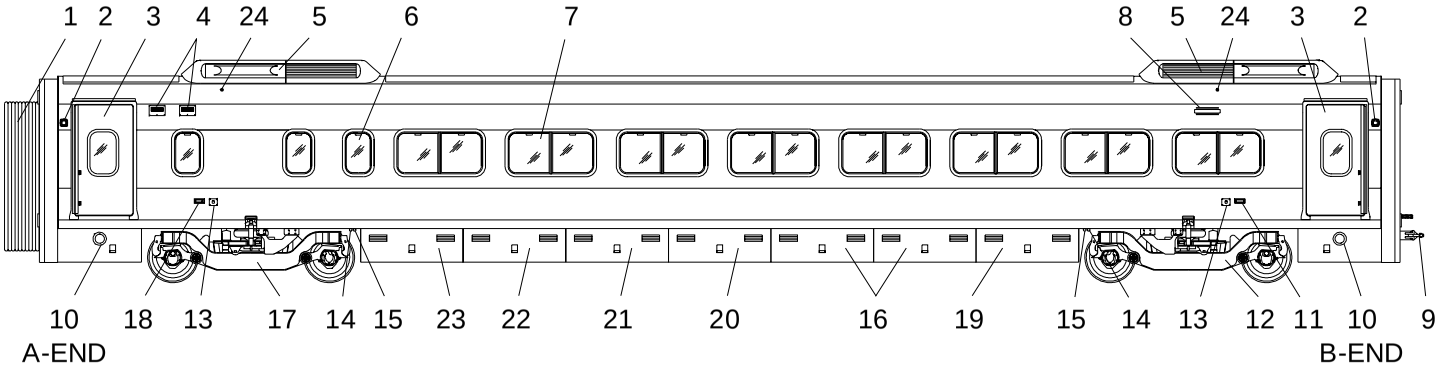
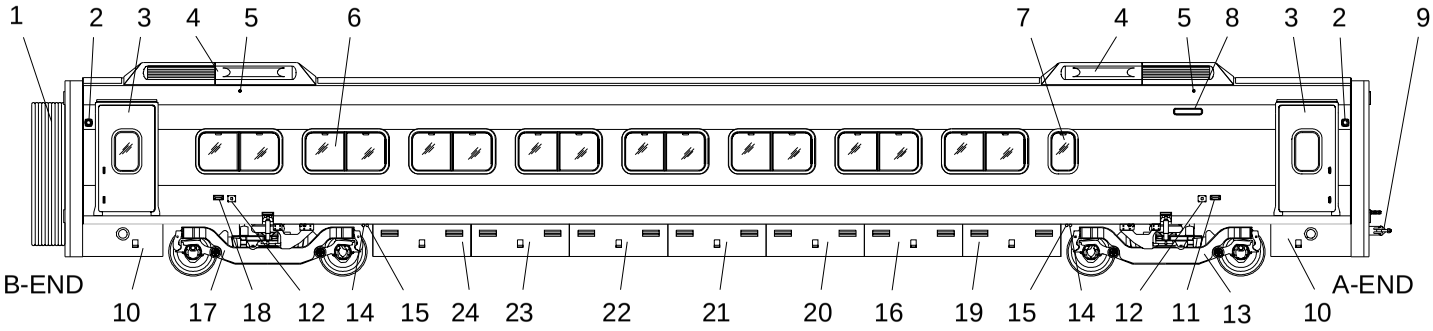
Figure 1-19
End Coach Car Interior Arrangement - Top View



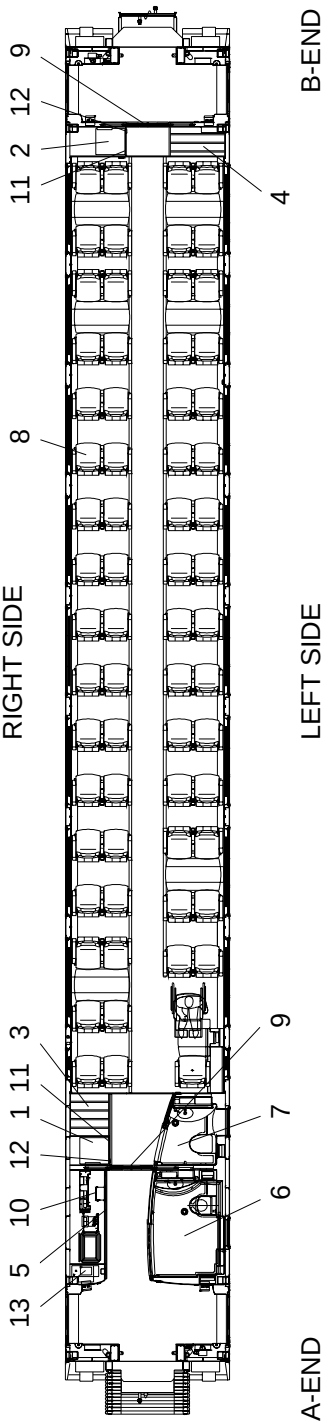
1. Diaphragm
2. Exterior Speaker
3. Side Door
4. Air Vent
5. HVAC Unit
6. Small Emergency Window
7. Large Emergency Window
8. Exterior Display Sign
9. Drawbar
10. Exterior Ground Light
11. Exterior Emergency Door Release Handle
12. B-End Truck
13. Exterior Crew Key Switch
14. Parking Brake Applied Gold Indicator
15. Brake Applied Red Indicator
16. Side Skirt/Access to Batteries
17. A-End Truck
18. Exterior Emergency Door Release Handle, with Emergency Rescue Station
19. Side Skirt/Access to Truck Brake Equipment Cutout Cock, Brake Control Unit, Air Reservoir
20. Side Skirt/Access to LVPS, Battery Charger
21. Side Skirt/Access to Water Filling Valve, Water Reservoir, Water Raising Unit
22. Side Skirt/Access to Waste Tank
23. Side Skirt/Access to Dump Valve, 480 V Junction Box, Truck Brake Equipment Cutout Cock
24. Door Open Red Indicator

Figure 1-20
Coach Car Exterior Arrangement - Left Side



1. Diaphragm
2. Exterior Speaker
3. Side Door
4. HVAC Unit
5. Door Open Red Indicator
6. Large Emergency Window
7. Small Emergency Window
8. Exterior Display Sign
9. Drawbar
10. Exterior Ground Light
11. Exterior Emergency Door Release Handle, with Emergency Rescue Station
12. Exterior Crew Key Switch
13. A-End Truck
14. Parking Brake Applied Gold Indicator
15. Brake Applied Red Indicator
16. Side Skirt/Access to Waste Service Line, Waste Tank
17. B-End Truck
18. Exterior Emergency Door Release Handle
19. Side Skirt/Access to Tilting Manifold, 480 V Junction Box
20. Side Skirt/Access to Water Reservoir, Water Filling Valve
21. Side Skirt/Access to Tilting Hydraulic Power Supply
22. Side Skirt
23. Side Skirt/Access to Transformer, Water Separator
24. Side Skirt/Access to Tilting Manifold, Air Reservoir

Figure 1-21
Coach Car Exterior Arrangement - Right Side



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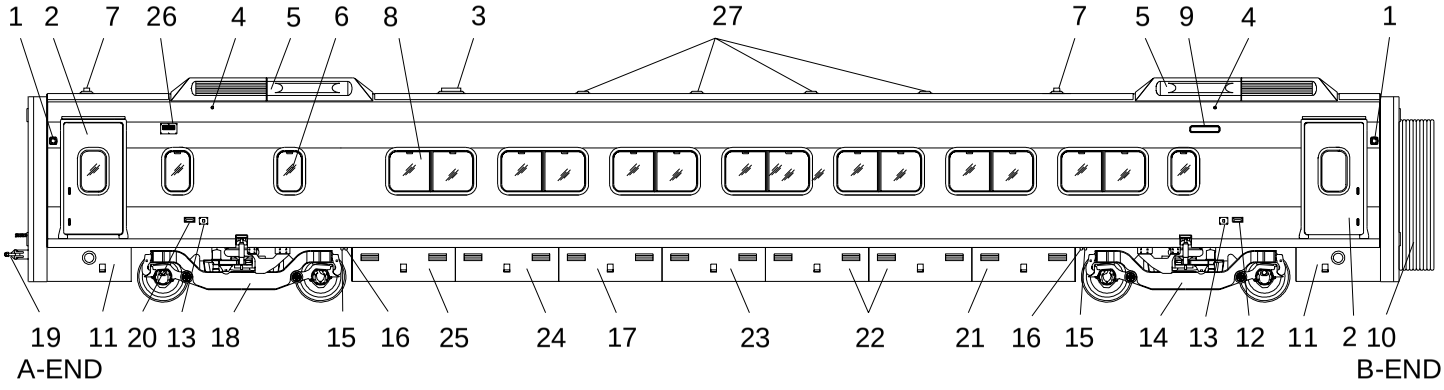
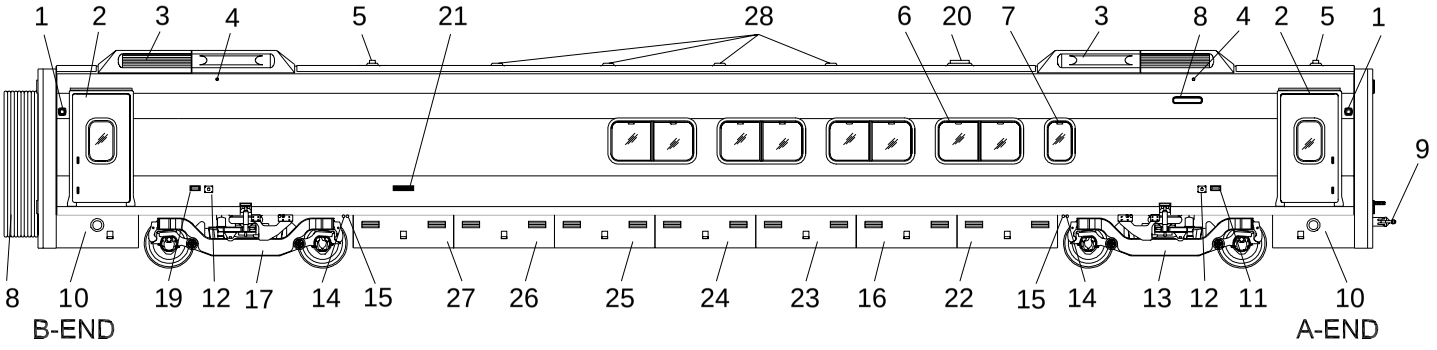
1. A-End Trash Compartment
2. B-End Trash Compartment
3. A-End Luggage Tower
4. B-End Luggage Tower
5. Electrical Locker
6. ADA Toilet Room
7. Conventional Toilet Room
8. Seat
9. Body End Door
10. Emergency Equipment Location
11. Conductor's Emergency Brake Valve and Truck Brake Equipment Cutout Cock
12. Emergency Blower Fan Switch, with HVAC and Door PTE Connectors
13. Water Fountain with Cooler

Figure 1-22
Coach Car Interior Arrangement - Top View



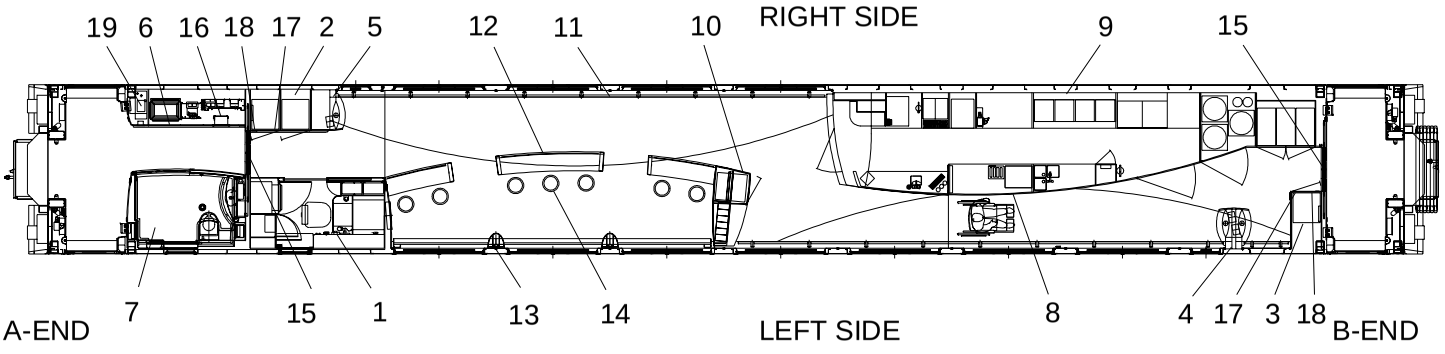
1. Exterior Speaker
2. Side Door
3. Voice Radio Antenna
4. Door Open Red Indicator
5. HVAC Unit
6. Small Emergency Window
7. Data Radio Antenna
8. Large Emergency Window
9. Exterior Display Sign
10. Diaphragm
11. Exterior Ground Light
12. Exterior Emergency Door Release Handle
13. Exterior Crew Key Switch
14. B-End Truck
15. Parking Brake Applied Gold Indicator
16. Brake Applied Red Indicator
17. Side Skirt/Access to Water Filling Valve, Water Reservoir, Water Raising Unit
18. A-End Truck
19. Drawbar
20. Exterior Emergency Door Release Handle, with Emergency Rescue Station
21. Side Skirt/Access to Truck Brake Equipment Cutout Cock, Brake Control Unit, Air Reservoir
22. Side Skirt/Access to Batteries
23. Side Skirt/Access to LVPS, Battery Charger
24. Side Skirt/Access to Waste Tank
25. Side Skirt/Access to Dump Valve, 480 V Junction Box, Truck Brake Equipment Cutout Cock
26. Air Vent
27. Provision for Rail Phone Antenna

Figure 1-23
Cafe Car Exterior Arrangement - Left Side



1. Exterior Speaker
2. Side Door
3. HVAC Unit
4. Door Open Red Indicator
5. Data Radio Antenna
6. Large Emergency Window
7. Small Emergency Window
8. Exterior Display Sign
9. Drawbar
10. Exterior Ground Light
11. Exterior Emergency Door Release Handle, with Emergency Rescue Station
12. Exterior Crew Key Switch
13. A-End Truck
14. Parking Brake Applied Gold Indicator
15. Brake Applied Red Indicator
16. Side Skirt/Access to Waste Service Line, Waste Tank
17. B-End Truck
18. Diaphragm
19. Exterior Emergency Door Release Handle
20. Voice Radio Antenna
21. Air Grille for Galley Equipment
22. Side Skirt/Access to Tilting Manifold, 480 V Junction Box
23. Side Skirt/Access to Water Reservoir, Water Filling Valve
24. Side Skirt/Access to Tilting Hydraulic Power Supply
25. Side Skirt
26. Side Skirt/Access to Transformer, Water Separator
27. Side Skirt/Access to Tilting Manifold, Air Reservoir
28. Provision for Rail Phone Antenna

Figure 1-24
Cafe Car Exterior Arrangement - Right Side



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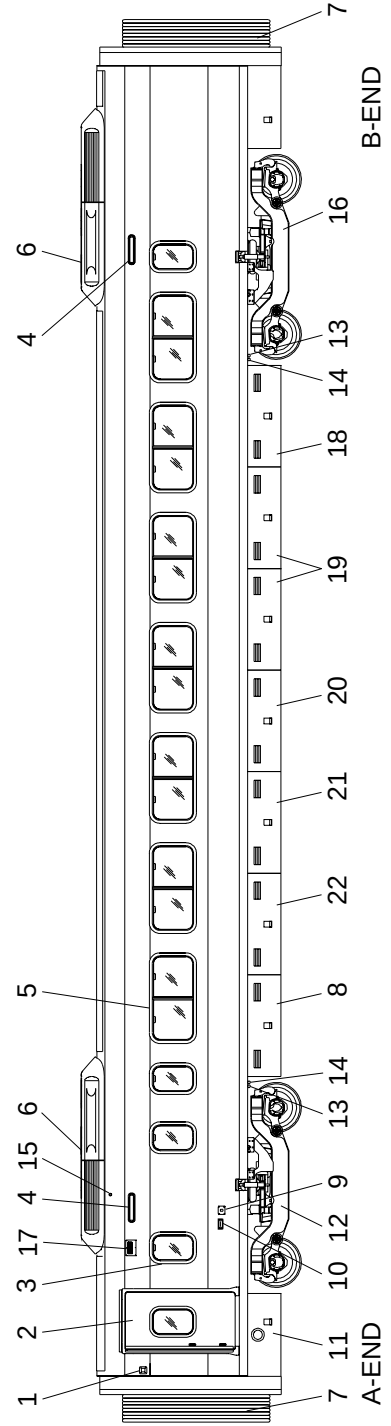
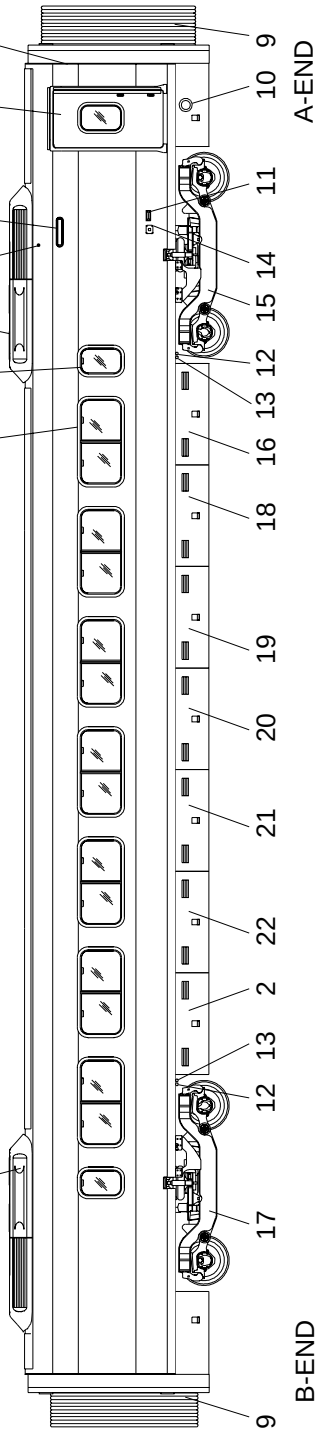
1. Crew Office
2. A-End Trash Compartment
3. B-End Trash Compartment
4. Phone Point B
5. Phone Point A
6. Electrical Locker
7. ADA Toilet Room
8. Inboard Galley
9. Outboard Galley
10. Service Island
11. Handhold
12. Lounge Table
13. Stand-Up Table
14. Cafe Seat
15. Body End Door
16. Emergency Equipment Location
17. Conductor's Emergency Brake Valve and Truck Brake Equipment Cutout Cock
18. Emergency Blower Fan Switch, with HVAC and Door PTE Connectors
19. Water Fountain with Cooler

Figure 1-25
Cafe Car Interior Arrangement - Top View



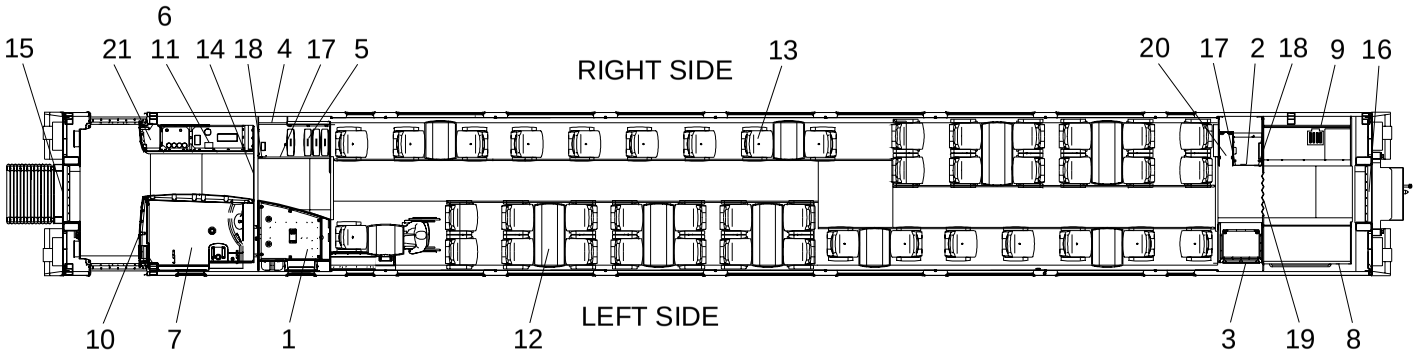
1. Exterior Speaker
2. Side Door
3. Small Emergency Window
4. Exterior Display Sign
5. Large Emergency Window
6. HVAC Unit
7. Diaphragm
8. Side Skirt/Access to Dump Valve, 480 V Junction Box, Truck Brake Equipment Cutout Cock
9. Exterior Crew Key Switch
10. Exterior Emergency Door Release Handle, with Emergency Rescue Station
11. Exterior Ground Light
12. A-End Truck
13. Parking Brake Applied Gold Indicator
14. Brake Applied Red Indicator
15. Door Open Red Indicator
16. B-End Truck
17. Air Vent
18. Side Skirt/Access to Truck Brake Equipment Cutout Cock, Brake Control Unit, Air Reservoir
19. Side Skirt/Access to Batteries
20. Side Skirt/Access to LVPS, Battery Charger
21. Side Skirt/Access to Water Filling Valve, Water Reservoir, Water Raising Unit
22. Side Skirt/Access to Waste Tank

Figure 1-26
First Class Car Exterior Arrangement - Left Side



1. HVAC Unit
2. Side Skirt/Access to Tilting Manifold, Air Reservoir
3. Large Emergency Window
4. Door Open Red Indicator
5. Exterior Display Sign
6. Small Emergency Window
7. Side Door
8. Exterior Speaker
9. Diaphragm
10. Exterior Ground Light
11. Exterior Emergency Door Release Handle, with Emergency Rescue Station
12. Parking Brake Applied Gold Indicator
13. Brake Applied Red Indicator
14. Exterior Crew Key Switch
15. A-End Truck
16. Side Skirt/Access to Tilting Manifold, 480 V Junction Box
17. B-End Truck
18. Side Skirt/Access to Waste Service Line, Waste Tank
19. Side Skirt/Access to Water Reservoir, Water Filling Valve
20. Side Skirt/Access to Tilting Hydraulic Power Supply
21. Side Skirt
22. Side Skirt/Access to Transformer, Water Separator

Figure 1-27
First Class Car Exterior Arrangement - Right Side



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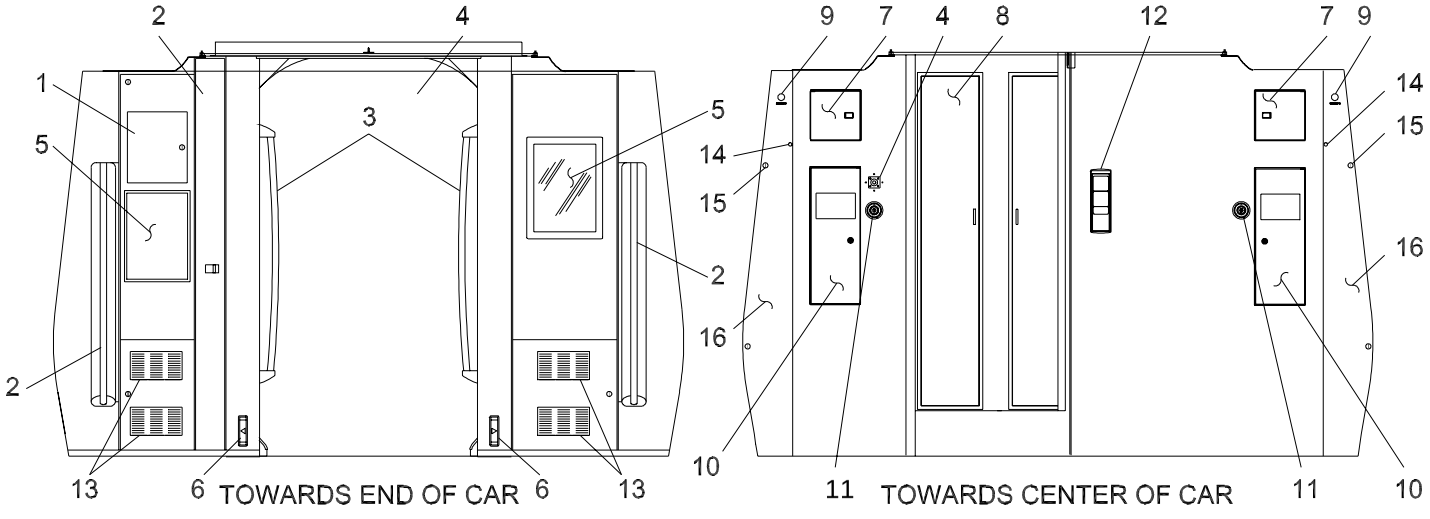
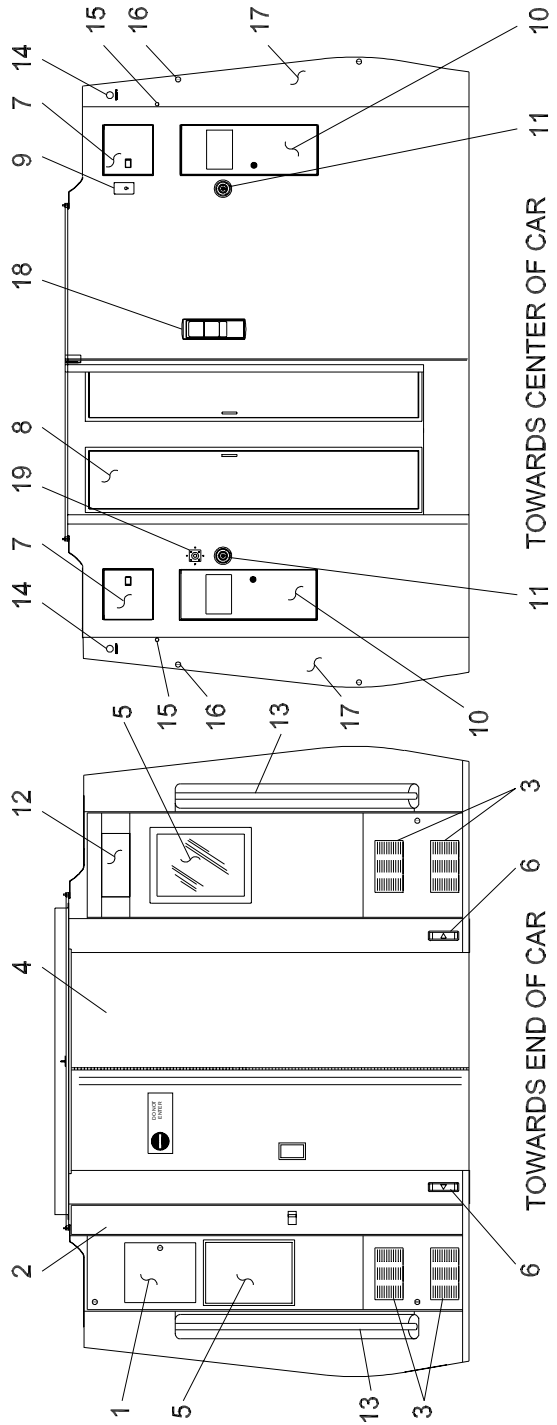
1. Telecom Center
2. Trash Receptacle
3. B-End Luggage Tower
4. A-End Trash Compartment
5. A-End Luggage Tower
6. Electrical Locker
7. ADA Toilet Room
8. Beverage Galley
9. Food Galley
10. Transverse Partition
11. Emergency Equipment Location
12. Table
13. Seat
14. Body End Door
15. Front End Door
16. Collision Post Door
17. Conductor's Emergency Brake Valve and Truck Brake Equipment Cutout Cock
18. Emergency Blower Fan Switch, with HVAC and Door PTE Connectors
19. Curtain
20. Closet
21. Water Fountain with Cooler

Figure 1-28
First Class Car Interior Arrangement - Top View



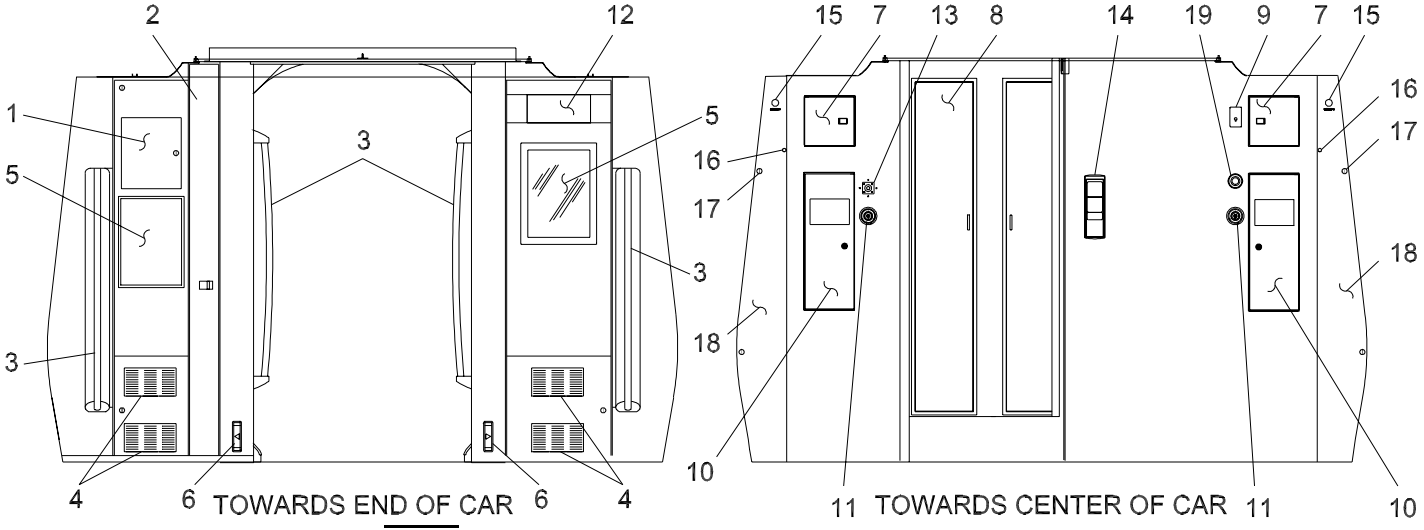
1. Communication Station
2. Emergency Ladder
3. Handhold
4. Thermostat
5. Advertising Sign
6. Emergency Exit Sign
7. Emergency Door Release Handle
8. Body End Door
9. Door Closing Indicating Light
10. Door Control Station
11. Passenger Door Open Pushbutton
12. Bulkhead Display Sign
13. Ventilation Grille
14. Access Panel Stopper
15. Access Panel Lock
16. Access Panel to Side Door Operator

Figure 1-29
A-End Vestibule Equipment Arrangement - Cafe Car and Coach Car



1. Communication Station
2. Emergency Ladder
3. Ventilation Grille
4. Power Car Access Door
5. Advertising Sign
6. Emergency Exit Sign
7. Emergency Door Release Handle
8. Body End Door
9. Body End Door Mode Selector Switch
10. Door Control Station
11. Passenger Door Open Pushbutton
12. Destination Sign
13. Handhold
14. Door Closing Indicating Light
15. Access Panel Stopper
16. Access Panel Lock
17. Access Panel to Side Door Operator
18. Bulkhead Display Sign
19. Thermostat

Figure 1-30
A-End Vestibule Equipment Arrangement - First Class Car and End Coach Car

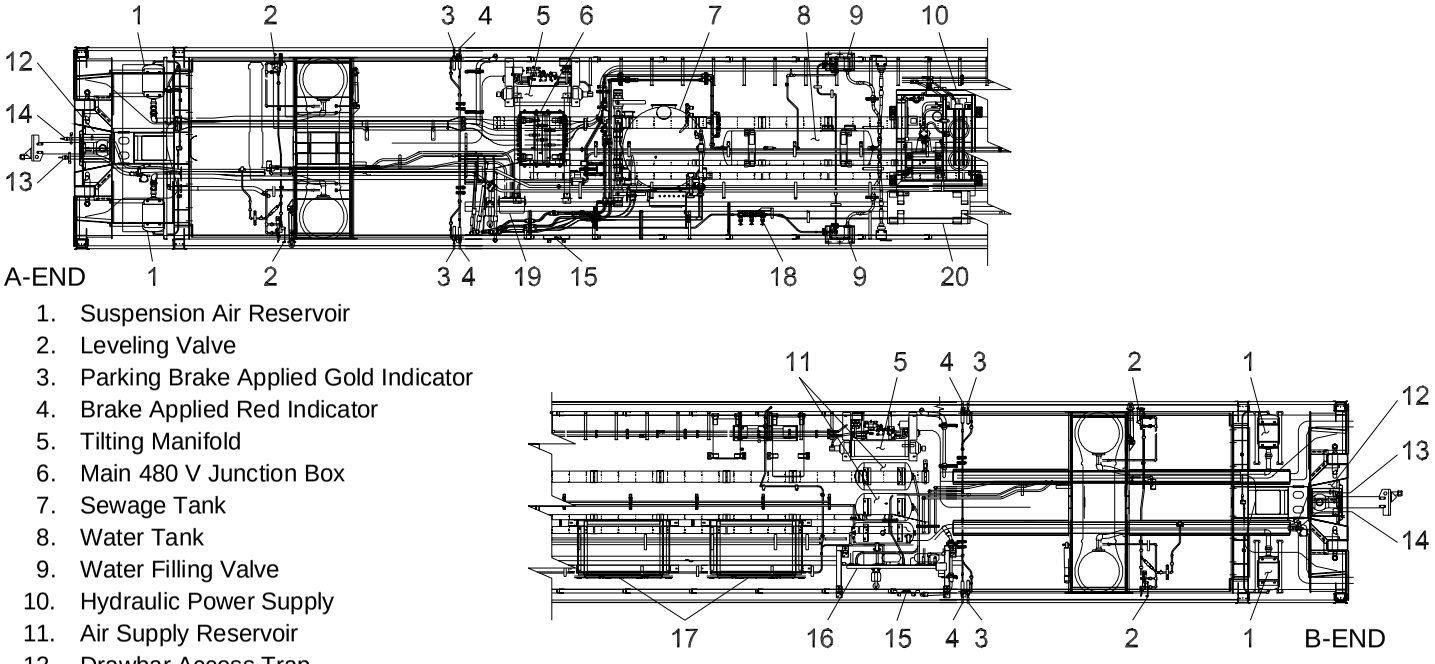


NOTE:

There is no entrance vestibule at the B-End of the First Class Car and End Coach Car, only a collision post door.

1. Communication Station
2. Emergency Ladder
3. Handhold
4. Ventilation Grille
5. Advertising Sign
6. Emergency Exit Sign
7. Emergency Door Release Handle
8. Body End Door
9. Body End Door Mode Selector Switch
10. Door Control Station
11. Passenger Door Open Pushbutton
12. Destination Sign
13. Thermostat
14. Bulkhead Display Sign
15. Door Closing Indicating Light
16. Access Panel Stopper
17. Access Panel Lock
18. Access Panel to Side Door Operator
19. Body End Door Open Pushbutton

Figure 1-31
B-End Vestibule Equipment Arrangement - Typical



1. Suspension Air Reservoir
2. Leveling Valve
3. Parking Brake Applied Gold Indicator
4. Brake Applied Red Indicator
5. Tilting Manifold
6. Main 480 V Junction Box
7. Sewage Tank
8. Water Tank
9. Water Filling Valve
10. Hydraulic Power Supply
11. Air Supply Reservoir
12. Drawbar Access Trap
13. Brake Pipe Cutout Cock
14. Main Reservoir Pipe Cutout Cock
15. Truck Equipment Cutout Cock
16. Pneumatic Brake Control Unit
17. Battery Box
18. Water Raising Unit
19. Dump Valve
20. Low Voltage Power Supply/Battery Charger (LVPS/BC)

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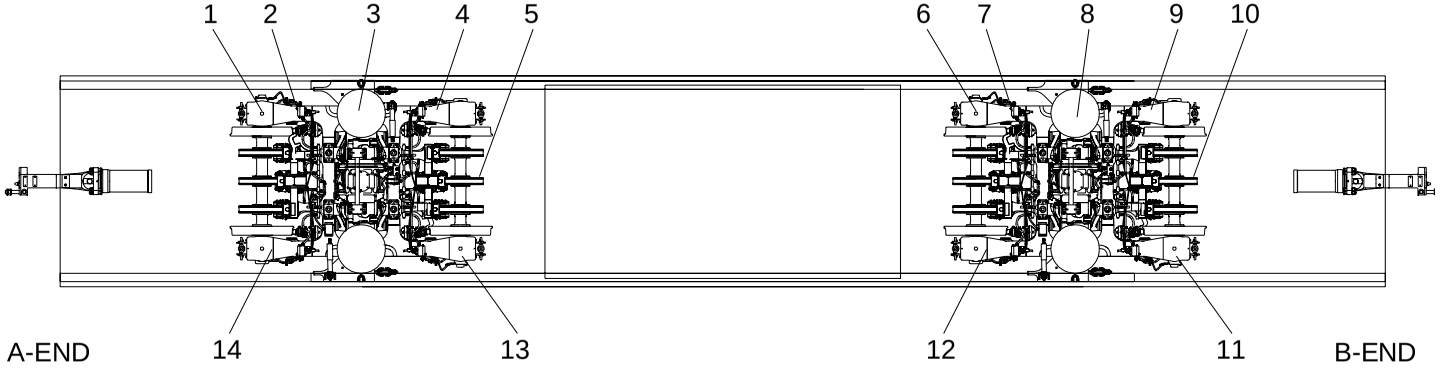
Figure 1-32
Passenger Car Underfloor Equipment Arrangement - Typical



1. Axle No. 1
2. Wheel No. R1, with Ground Brush
3. A-End Truck
4. Wheel No. R2, with Wheel Slide Speed Sensor
5. Axle No. 2
6. Axle No. 3
7. Wheel No. R3, with Ground Brush
8. B-End Truck
9. Wheel No. R4, with Wheel Slide Speed Sensor
10. Axle No. 4
11. Wheel No. L4, with Ground Brush
12. Wheel No. L3, with Wheel Slide Speed Sensor
13. Wheel No. L2, with Ground Brush
14. Wheel No. L1, with Wheel Slide Speed Sensor

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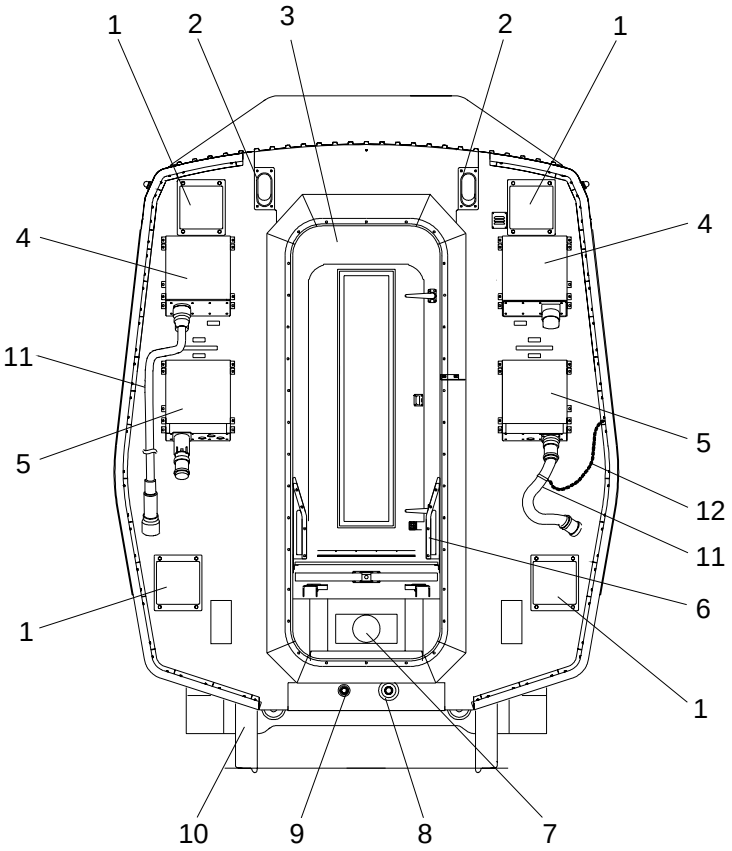
Figure 1-33
Passenger Car Trucks, Wheels and Speed Sensors Arrangement (Top View) - Typical



1. Energy Absorber
2. Lifting Lug
3. Door
4. Train Control and Communication Trainline Receptacle
5. 480 V Trainline Receptacle
6. Diaphragm
7. Drawbar
8. Brake Pipe
9. Main Reservoir/Equalizing Pipe
10. Truck
11. Jumper
12. Jumper Cable Safety Chain

AB000025

Figure 1-34
Passenger Car End Exterior Equipment Arrangement - Typical

SECTION 1.3
GENERAL DESCRIPTION

This section contains a general description of the major systems of the trainset.

1.3.1 INTRODUCTION. The Bombardier Alstom Consortium high-speed trainset is shown on Figure 1-1. It comprises an advanced tilting system and technology for high speed and comfort, and safety is its top priority. It incorporates high-powered braking and microprocessor controlled wheel slide protection along with in-car emergency features.

1.3.2 GENERAL ARRANGEMENT (Fig. 1-35). The high-speed trainset has two engines, each identified as a power car. For each power car, power for operating the trainset is obtained, through a pantograph, from an overhead alternating current supply of 12kV at 25 Hz, 12.5 kV at 60 Hz, or 25 kV at 60 Hz. Power is routed to the main circuit breaker, MCB-1, and the output from the main circuit breaker is applied to two primary windings of the main transformer. The two primary windings are connected in parallel when the overhead line voltage is 12 kV at 25 Hz or 12.5 kV at 60 Hz. The two primary windings are connected in series when overhead line voltage is 25 kV at 60 Hz. A motor-driven tap changer switch, which makes the parallel or series connection, is located next to the central block, below the four-function unit.

The main transformer is a fixed-ratio-type, multiple-secondary transformer. Four forced commutation rectifier bridges (FCRBs), operate between the four secondaries and a common bus. This bus, called the DC-Link, has a nominal voltage of 2750 Vdc. Two motor inverters operate between the DC-Link and the four asynchronous alternating current traction motors. Each inverter feeds two traction motors. A third inverter, the auxiliary inverter, is fed by the DC-Link and produces a 1780 Vac, three-phase, 60 Hz output that the auxiliary transformer steps down to produce the HEP. The auxiliary inverter of the trailing power car is the first inverter to be activated at startup. The forced commutation rectifier bridges, the two motor inverters, and the auxiliary inverter are located in the central block.

Both the forced commutation rectifier bridges and the inverters are based on gate turnoff thyristors (GTO). The direction and amount of power flow is controlled by the timing and sequencing in the operation of the GTOs. In traction mode, the power flows from the catenary to the traction motors. In braking mode, the power flows to the catenary if receptive, or, if not, either to the auxiliary inverter or, through rheostatic choppers, to brake resistors.

The direct current bus voltage is smoothed by a filter, called the 2F filter, designed to filter out the second harmonic of the catenary voltage 25 Hz or 60 Hz fundamental. The 2F filter reactor is located in the main transformer block undercar. The 2F filter capacitor bank is located in the auxiliary block. The 2F filter inductor is located in the main transformer block.

There are four alternating current traction motors on each power car, two per truck. These are 4-pole, squirrel cage motors.

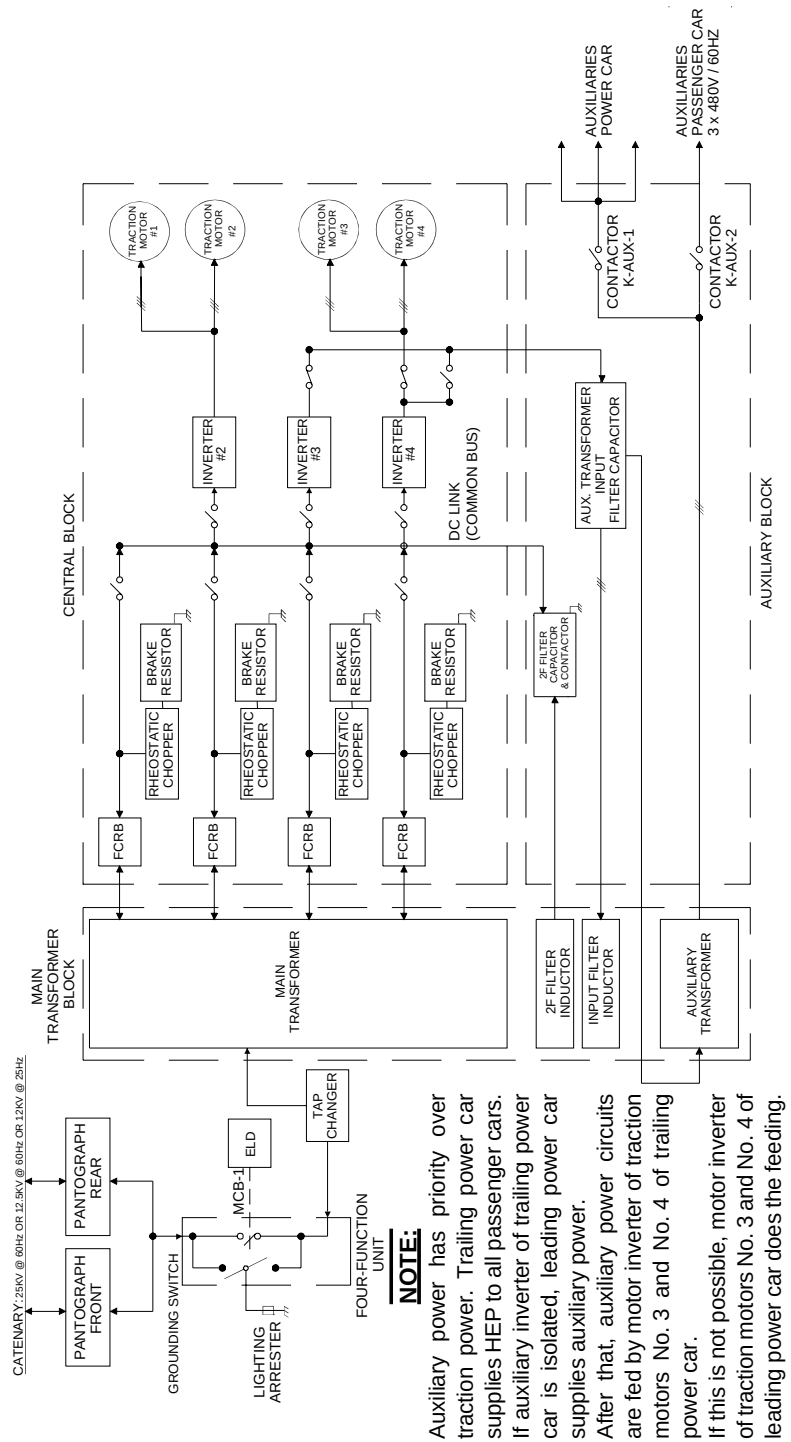


Figure 1-35
Main Electrical Power Flow Diagram

NOTE:

Auxiliary power has priority over traction power. Trailing power car supplies HEP to all passenger cars. If auxiliary inverter of trailing power car is isolated, leading power car supplies auxiliary power. After that, auxiliary power circuits are fed by motor inverter of traction motors No. 3 and No. 4 of trailing power car. If this is not possible, motor inverter of traction motors No. 3 and No. 4 of leading power car does the feeding.

1.3.2.1 Cooling Equipment. Each power car has three different cooling systems for the propulsion equipment:

- Water cooling: Two water pumps circulate a water/glycol mixture through two radiators in the central block.
- Oil cooling: Two oil pumps circulate oil through the main transformer radiators.
- Forced air cooling: Four blowers circulate air through the central block; two others are used for the main transformer and the rheostatic brake resistors. Traction motor cooling is provided by two traction motor blowers, one per truck.

All pumps and blowers are powered by 480 Vac power.

1.3.2.2 Power Car Braking System. The power car braking system incorporates blended regenerative/rheostatic dynamic braking supplemented by friction braking. It uses wheel-mounted discs and tread brakes on each wheel, and it features redundant wheelslide protection and nonrotating axle detection.

1.3.2.3 Passenger Car Braking System. All passenger cars have tread brakes on each wheel and three high-powered discs on each axle. They also feature redundant wheelslide protection and nonrotating axle detection.

1.3.2.4 Monitoring System. Dedicated computers control diagnose and monitor systems and subsystems for optimum safety and reliability.

1.3.2.5 Tilting System. The high-speed trainset tilting system is computer-controlled and hydraulically activated. It assures full stability and passenger comfort when negotiating curves at the highest speeds. Microprocessors control the tilting system allowing the cars to counteract lateral forces.

All passenger cars are equipped with an active, electrohydraulic tilting system that maintains low lateral acceleration felt by passengers through curves at high speed. The power car is designed for high cant deficiency operation but is not equipped with a tilting mechanism. The tilting system incorporates key features as advance curve detection and microprocessor-based controls with monitoring and self-diagnostic capabilities to ensure performance, reliability, and ease of maintenance.

1.3.2.6 Trucks. The high-speed trainset trucks are designed for high-speed stability operation, with outboard bearings and a fabricated frame.

1.3.2.7 Coupler. The power car is equipped with a Tightlock coupler, with type H head, at the front. Semipermanent drawbars are used everywhere else in the trainset.

1.3.2.8 Suspension. The power car uses primary and secondary helicoil springs. The passenger car use primary helicoil springs and secondary air springs.

1.3.2.9 Air Comfort. Each passenger car is equipped with two self-contained overhead mounted HVAC systems complemented with floor heating.

1.3.2.10 Doors. The side doors in all passenger cars are of the outside sliding plug type, for high platform boarding, with electropneumatic operation.

1.3.2.11 Communication Systems. The high-speed trainset communication systems are composed of the following:

1.3.2.11.1 Attendant Call System. Allows crew members to know when and where passengers need their help.

1.3.2.11.2 Entertainment System. Provides audio to the passengers of the first class car, end coach car, and coach cars, and audio and video to the passengers of the cafe car.

1.3.2.11.3 Passenger Information System: Composed of different display signs that give written information to the passengers.

1.3.2.11.4 Voice Communication System: Comprises the Intercom (IC) that permits verbal exchanges between crew members, Public Address (PA) that allows crew members to give verbal information to the passengers, and radio communication that permits crew members to communicate with the wayside.

1.3.2.12 Passenger Services. The high-speed trainset passenger services comprise the following:

- Fully ADA compliant
- Public phone booths
- ADA and unisex toilet
- Audio entertainment in all passenger cars
- Video entertainment in the cafe car
- Public address system
- Information sign displays
- Rotating seats with folding tables
- Beverage galley in the cafe car, first class car and end coach car
- Food galley in the cafe car and first class car.

SECTION 1.4
PRINCIPLES OF OPERATION

This section contains a functional description of the equipment operation, where applicable.

NOTE:

Only the information pertaining to the train crew is included. The descriptions are only to the extent necessary for an understanding by persons unfamiliar with the trainset or its equipment.

1.4.1 CARBODY, INTERIOR FIXTURES, OPERATING CAB. Refer to Subsection 2.1.1, on page 2-1, "Carbody, Interior fixtures, Operating Cab (Fig. 2-1 to 2-5)" for a description of the controls and indicators related to the operation of the components described in the following subsections.

1.4.1.1 Refrigerator. A small refrigerator is installed at the bottom of the power car cab wall. Another one is installed in the crew office of the cafe car.

1.4.1.2 Toolbox. The toolbox on the power car cab wall contains an adjustable wrench, a pinch bar, and a first aid kit.

1.4.1.3 Fire Extinguishers. The power car has three fire extinguishers, one in the FIRE EXTINGUISHER locker on the cab wall, and two others in the equipment room, one on each side.

1.4.1.4 Power Car Ladder. The power car equipment room ladder can be used to access the roof, for maintenance purposes only.

WARNING:

TO PREVENT INJURY OR DEATH, NEVER ACCESS THE ROOF WITH THIS LADDER WHILE THE TRAINSET IS IN OPERATION.

1.4.1.5 Cab Seats. The engineer and the assistant seats are fully adjustable.

1.4.1.6 Windshield Heater. The heater is integrated into the windshield.

1.4.1.7 Wipers and Windshield Washer. The cab is equipped with two windshields, with one wiper and one windshield washer spray nozzle for each windshield.

1.4.1.8 Adjustable Footrest. The footrest under the engineer's console allows height adjustment of the floor-mounted equipment.

1.4.1.9 Sun Visors. The visors on the top part of the windshield protect the engineer and the assistant against glare.

1.4.1.10 Mirrors. The retractable mirrors on each side of the power car allow the engineer vision to the rear of the power car cab.

1.4.1.11 Horn. A pneumatic horn is installed on the roof, at each end of the power car.

1.4.1.12 Bell. A pneumatic bell is located at the left side undercar, near the F-End of the power car.

1.4.1.13 Sanding System. Pneumatic sanders deposit sand in front of the wheels. They are located undercar near each truck front wheel, at both ends of the power car.

1.4.1.14 Passenger Seats. The coach car and the end coach car have 65 seats, divided into the following five categories:

- Six Double Fixed Seats with accessories
- Seven Double Fixed Seats without accessories
- 18 Double Rotating Seats
- One Single ADA Seat (Right-Hand)
- One Double ADA Seat (Left-Hand).

The backrest of each seat can recline 30°. The reclining position of the back-to-back seats, or those on a partition, is limited to 17°.

The first class car has 44 seats, divided into the following five categories:

- Two Double Rotating Seats with accessories
- Five Double Fixed Seats with accessories
- Six Double Fixed Seats without accessories
- Six Single Rotating Seats with accessories
- Seven Single Fixed Seats with accessories
- Three Single Fixed Seats without accessories
- One Single ADA Accessible Seat (Left-Hand) without accessories
- One Single ADA Accessible Seat (Right-Hand) without accessories.

The backrest recline is the same as for coach cars seats but, for the back to back seat installation, the reclining position is limited to 20°.

1.4.1.15 Rest Rooms. In each car, the ADA rest room is located at the A-End Left Side. It is equipped with an infant changing table and a diaper trash compartment. The coach car has another unisex rest room next to the ADA rest room.

1.4.1.16 Car Convenience Group. The car convenience group of the passenger cars includes the followings items:

- Luggage Racks
- Luggage Towers
- Trash and Storage Compartments
- Service Island
- Tables
- Curtain
- Dry Storage Compartment
- Telephone Booth

- Emergency Ladder
- Handholds
- Crew Office Refrigerator.

The overhead luggage racks are located on each side of the passenger area, above the seats.

In the first class car, a curtain is installed to separate the food galley from the passenger seating area.

An emergency foldable ladder is stored in a locker located in each end vestibule of all types of passenger cars. In the first class car and the end coach car, the ladder in the A-End vestibule is located close to the front end door.

1.4.2 TRUCK AND SUSPENSION. The functional description of the truck and suspension equipment operation includes the Integrated Truck Surveillance System (ITSS), the Tilting System, and the onboard failure detection trainline architecture. Refer to Subsection 2.1.2, on page 2-7, "Truck and Suspension" for a description of the controls and indicators related to these systems.

1.4.2.1 Integrated Truck Surveillance System. The Integrated Truck Surveillance System (ITSS) is composed of the following:

- Integrated Truck Surveillance Unit (ITSU)
- Truck hunting accelerometers (one per truck)
- Hot bearing temperature sensors (4 per truck)
- Air bag pressure monitoring function.

The truck hunting accelerometers monitor truck instability by measuring the lateral acceleration of each truck. The hot bearing temperature sensors monitor the temperature of each truck journal bearing. The air bag pressure sensors monitor each air bag pressure for overinflation.

In normal operation, the ITSS monitors each hot bearing temperature sensor, truck hunting accelerometer, and air bag sensor. It provides information about each component condition and operation outside normal operating range.

When a temperature sensor detects an abnormal bearing temperature, a hot bearing alarm (212 ^{o}F), is triggered. The appropriate ITSU front panel indicator illuminates, the "onboard failure" trainline becomes energized, and the ONBOARD FAILURE indicator on the engineer’s overhead switch panel turns on.

When an accelerometer detects a truck hunting (acceleration above the specified rate), an alarm is triggered. The appropriate ITSU front panel indicator turns on, the "onboard failure" trainline becomes energized, and the ONBOARD FAILURE indicator on the engineer’s Overhead Switch Panel turns on.

The air bag pressure monitoring function monitors the air pressure level in the passenger cars suspension air bags. The ITSU monitors the air bag pressure switch. If the switch opens and main air reservoir pressure is normal, the alarm condition is activated. After the alarm announcement in the cab, the engineer must acknowledge the alarm and reduce the speed according to Amtrak’s operating procedures.

When a malfunction is detected, the Multifunction Display No. 1 (MFD1) and the Primary Operating Display (POD) inform the engineer of the specified alarm. (Refer to Subsection 2.2.7, on page 2-146, "En Route Procedures" for detailed operating procedures.)

1.4.2.2 Onboard Failure Detection System. The "onboard failure" trainline is connected to the ITSS, the fire detection system and the tilting system. When a hot bearing, truck hunting, equipment room fire, or a car not centered properly is detected, the following occurs:

- The "onboard failure" trainline is energized.
- The ONBOARD FAILURE Indicator turns on.
- The appropriate information is displayed on Multifunction Display No. 1 (MFD1) and Primary Operating Display (POD) of the lead power car.

Pressing the SELF TEST and LAMP TEST buttons simultaneously on the ITSU front panel bypasses a faulty sensor (or accelerometer), and restores trainline functionality.

The ITSU sealed CUTOUT switch is used to bypass a faulty ITSU. The ONBOARD TL bypass switch on the cab rear wall switch panel is used to bypass a faulty trainline.

1.4.2.3 Tilting System. The operation of the tilting system starts with advanced curve detection signals provided by two tilting master sensors on the leading power car foremost truck. These sensors detect the lateral acceleration, the rate of change of track super-elevation (roll rate) and the rate of change of truck rotation (yaw rate). The speed sensing unit provides speed signals to the tilting master sensors for internal compensations.

The sensor signals are processed by the tilting master controller which computes the amount of tilting required for each passenger car considering the position of each car in the trainset, the trainset speed, and the curve tightness. The tilting master controller then communicates the set-points to each car tilting car controller. This process enables the cars to tilt or to return to the centered position at the proper rate, which provides smooth transitions during curve entry and exit.

The tilting car controller on each passenger car initiates the tilting action by generating a tilting command for a dedicated tilting hydraulic controller, which controls the tilting angle and rate through the truck-mounted tilting cylinder units.

The tilting system software enables tilting motion at speeds above 30 mph, increasing gradually the compensation of lateral acceleration up to 75 % at speeds of 45 mph or more. The 75 % compensation, while inducing slight steady-state acceleration on the passenger, significantly reduces the large tilting motions that might otherwise occur on short spiral curves.

The tilting operation is also controlled by hardware. The "presence detection" trainline forces the cars into centered position and inhibits tilting at speeds lower than 25 mph or following a system component malfunction.

The tilting car controller monitors the status of the tilting system and controls power to the tilting components. The tilting car controller is also responsible for opening and closing the "centering detection" trainline contact that either permits or inhibits the centering detection signal to flow into the tilting car controller.

The system safety is implemented at multiple levels within the tilting hydraulic controller and by independent digital circuits. If an anomaly is detected on one car, the hydraulic mode selector valves allow the car to return to the centered hydraulically locked position. At the same moment, the "presence detection" trainline opens to shut down the other passenger cars systems.

1.4.3 COUPLER. The power car is equipped with one AAR Type-H Tightlock coupler at the front and one semipermanent drawbar at the rear. All the passenger cars are semipermanently coupled with semipermanent drawbars. Coupling and uncoupling of any car is performed manually. Refer to Subsection 2.1.3, on page 2-14, "Coupler (Fig. 2-16)" for a description of the available controls and indicators.

1.4.4 ELECTRICAL DISTRIBUTION SYSTEM. The electrical distribution system of the high-speed trainset is made up of the following components:

- Power car Low Voltage Battery Charger (LVBC)
- Passenger cars Low Voltage Power Supply/ Battery Charger (LVPS/BC)
- Battery and Battery Controls
- Circuit Breakers
- Passenger cars Uninterruptable Power Supply (UPS).

Refer to Subsection 2.1.4, on page 2-21, "Electrical Distribution System (Fig. 2-17 to 2-22)" for a description of the controls and indicators related to these components.

1.4.4.1 Low Voltage Battery Charger (LVBC). The power car has two low voltage battery chargers located in the equipment room, at the F-End, right side. The Low Voltage Battery Charger (LVBC) components are the contactor assembly, the temperature monitors, and the input voltage monitor. The Head End Power (HEP), or shop supply, feeds the LVBC. The LVBC generates the 72 Vdc for the battery and the low voltage distribution network. It has its own microcontroller.

For protection, the two redundant LVBCs are tied to the same output, but only one is active at any time. The LVBCs are controlled by the Propulsion Electronic Control Unit (PECU).

1.4.4.1.1 Low Voltage Power Supply/ Battery Charger (LVPS/BC). In each passenger car, the HEP feeds the Low Voltage Power Supply/ Battery Charger (LVPS/BC). The LVPS and the BC modules of the LVPS/BC are fed separately, and both have nominal 72 Vdc outputs. They are interchangeable modules, with their function and name determined by the LVPS/BC enclosure coded connectors.

1.4.4.2 Battery and Battery Controls. The power car battery consists of two nickel-cadmium battery racks, with five trays each, located in the two battery boxes at the rear of the equipment room. Each tray contains five cells. The battery is the alternate source of 72 Vdc when it is unavailable from the LVBC. It supplies power for 15 minutes in stage I, and for seven hours in stage II, or until end of cell.

The passenger cars battery is also the alternate source of 72 Vdc, when it is unavailable from the LVPS/BC. It supplies power for seven hours by feeding the same three buses fed normally by the LVPS/BC.

1.4.4.3 Circuit Breakers. All the high-speed trainset circuit breakers are listed, and their location indicated, in Subsection 2.1.4, on page 2-21, "Electrical Distribution System (Fig. 2-17 to 2-22)". They feed and protect the following systems:

Table 1-1
Circuit Breaker Voltages for Each System

SYSTEM	480 Vac	208 Vac	120 Vac	72 Vdc	28 Vdc
Carbody, Interior Fixtures, Operating Cab			X	X	
Truck and Suspension (including Tilting and Integrated Truck Surveillance System)	X			X	
Electrical Distribution System	X		X	X	X
Lighting and Indicators			X	X	
Doors, Door Control and Signal System					
HVAC	X		X	X	
Communication Systems				X	
Propulsion and Electric Braking (including Fire Suppression System and Electromagnetic Interference Limit Detector)	X			X	
Friction Brake Equipment/Air Supply	X			X	
Cab Signal and Automatic Train Control Systems (including Alerter/Recorder and Advanced Civil Speed Enforcement System)				X	
Train Monitoring and Data Management Systems				X	
Water and Waste Retention System			X	X	
Galleys		X			X

1.4.4.4 Uninterruptable Power Supply. The Uninterruptable Power Supply (UPS) is located at the bottom of the electrical locker. In case of 480 V (and 120 Vac) power loss, it maintains the 72 Vdc power supply to energize some components of the passenger cars lighting system.

1.4.5 LIGHTING AND INDICATORS. The power car lighting system provides illumination to the cab, equipment room, and exterior, as well as normal walkway lighting. It also provides lighting during maintenance, emergency, and for access to the power car.

The interior lighting system of the passenger cars provides a sufficient amount of light in the passenger areas, toilet, and telephone areas. The exterior lighting system provides the appropriate amount of lighting required to safely operate the trainset.

Refer to Subsection 2.1.5, on page 2-36, "Lighting and Indicators" for a description of the lighting system controls and indicators.

1.4.5.1 Exterior Lighting. The power car exterior lighting comprises the following equipment: Headlights, marker lights, ditch lights, exterior ground lights. Near each passenger car side door, the ground is illuminated with a light fixture mounted outside the car.

1.4.5.2 Interior Lighting. The power car interior lighting comprises the following equipment: Cab ceiling lights, timetable and console lights, cab step light, walkway lights, maintenance lights, toilet light and intercar passageway light. In the passenger cars, the interior lighting provides a sufficient amount of light for all the passenger areas, including passageways, aisle, galley, toilet, communication center, seats.

1.4.6 DOORS, DOOR CONTROL AND SIGNAL SYSTEM. This section covers the principles of operation of all the trainset exterior and interior doors. Refer to Subsection 2.1.6, on page 2-37, "Doors, Door Control and Signal System" for a description of the controls and indicators related to the operation of these doors.

1.4.6.1 Side Doors. The passenger cars side doors are pneumatically operated and electrically controlled and monitored. They are operated and monitored within the train control and operating system. In normal operation, they are controlled either by the local Door Control Station (DCS) or by another DCS (on the same side) through trainlines. All side doors throughout the trainset operate identically.

The door system includes obstacle detection. If the door is not able to close, it reopens and attempts to close again three times. The door then remains open until a further close command is given. If the door does not close following the receipt of valid close commands, a door open status is indicated on the cab display units. The side doors close automatically when car electrical power and pneumatic pressure are available.

1.4.6.2 Interior Doors. There are two kinds of interior doors, the body end doors and the collision post doors. The body end doors are located in all passenger cars. The collision post doors are located at the A-End of the end coach car and at the B-End of the first class car. The main difference between both types of door is the overall dimension. All the doors operate in the same manner. The door opens automatically when a passenger is detected by an infrared detector. The door can also be opened by pressing on a pushbutton.

Each interior door comprises a pair of biparting, sliding doors. The doors are pneumatically operated with the operation initiated and monitored electrically. The interior doors include obstacle detection. If the doors are not able to close, they reopen.

The end coach car and the first class car are also equipped with a front end door (hinged door) at the A-End to allow access to the power car.

1.4.7 HEATING, VENTILATION, AND AIR CONDITIONING. The HVAC system in each car is fully automatic and depends on the various switches settings. The temperature for the power car cab and in the passenger areas of all other cars is controlled by the Temperature Control Unit (TCU) of each HVAC unit.

1.4.7.1 Power Car HVAC System. The Heating, Ventilation, and Air Conditioning (HVAC) system in the power car regulates the temperature of the cab area and the toilet module. The HVAC system has the following functions:

- Heating through the forced air cab heaters, the HVAC unit, and the toilet forced air heaters
- Ventilation by means of the HVAC unit
- Air conditioning by means of the HVAC unit
- Freeze protection by means of heater strips located throughout the power car
- Defogging by means of the windshield defogger.

Refer to Subsection 2.1.7, on page 2-41, "Heating, Ventilation, and Air Conditioning (Fig. 2-24)" for a description of the controls and indicators related to the operation of the HVAC system in the power car.

1.4.7.2 Passenger Car HVAC System. The HVAC system in the passenger cars regulates the temperature of the following areas:

- Passenger Area
- Toilet Area
- Crew Office Area
- Cafe Car Galley Area
- First Class Car Galley Area
- Phone Point Area
- Telephone Booth Area
- Vestibule Area.

In each car, the HVAC system has the following functions:

- Heating through the forced air heaters, the HVAC unit, the floor heaters, and the toilet forced air heaters
- Ventilation by means of the HVAC unit and the booster fans
- Air conditioning by means of the HVAC unit
- Freeze protection by means of heater strips located throughout the trailer car

The HVAC unit, on top of the trailer car draws in fresh air and mixes that air with recirculated air. The air mixture is drawn through air filters, evaporator coil, and heating surfaces before going into the main air duct. In the main air duct, the air goes either to the passenger area or to the vestibule area by means of booster

fans. The heating capacity is improved by forced air heaters situated in vestibules, toilet, and phone point areas. Most of these functions are controlled by the temperature control unit.

Refer to Subsection 2.1.7, on page 2-41, "Heating, Ventilation, and Air Conditioning (Fig. 2-24)" for a description of the controls and indicators related to the operation of the HVAC system in each passenger car.

1.4.7.3 Temperature Control Chart (Fig. 1-36). The operation of each car HVAC system depends on the settings established in its Temperature Control Chart (TCC). The passenger TCC for the passenger area is shown on Figure 1-36.

1.4.7.4 Fresh Air Dampers. Each HVAC unit is equipped with fresh air dampers. The dampers operation is controlled by the interior temperature. The dampers close when the interior temperature falls below 67 °F or rises above 79 °F. The dampers open when the interior temperature rises above 69 °F or falls below 77 °F. (The temperatures may vary by ±3 °F depending on the Temperature Control Switch setting.)The dampers also close when the system is in layover mode.

Whenever necessary (as when in a tunnel at the same time than a diesel locomotive), the fresh air dampers can be opened or closed by the engineer with the FRESH AIR DAMPERS switch. The switch bypasses the TCU control over all dampers in the trainset.

1.4.8 COMMUNICATION SYSTEMS. The high-speed trainset communication systems are composed of the following systems:

- Voice Communication System (Public Address, Intercom, radio communication)
- Attendant Call System
- Entertainment System
- Passenger Information System.

Refer to Subsection 2.1.8, on page 2-45, "Communication Systems (Fig. 2-25 to 2-33)" for a description of the controls and indicators related to these systems.

1.4.8.1 Public Address. The trainset Public Address (PA) allows crew members to give verbal information to the passengers. The PA messages are broadcast in different forms and from different locations, such as:

- Messages from the engineer and the assistant locations in the cab
- Messages from a passenger car communication station
- Entertainment audio from video system or compact disk player
- Prerecorded announcement message launched from the workstation in the cafe car (refer to Subsection 1.4.12.10, on page 1-73, "DMS Interfaces" and Subsection 2.1.12.12, on page 2-120, "Workstation" for a description of the workstation).
- Door closing announcement from the Bistro Communication Control Unit (BCCU, cafe car).

The PA message is heard in all cars speakers and in passenger headsets of selected cars. The PA zoning is selected from the workstation in the cafe car.

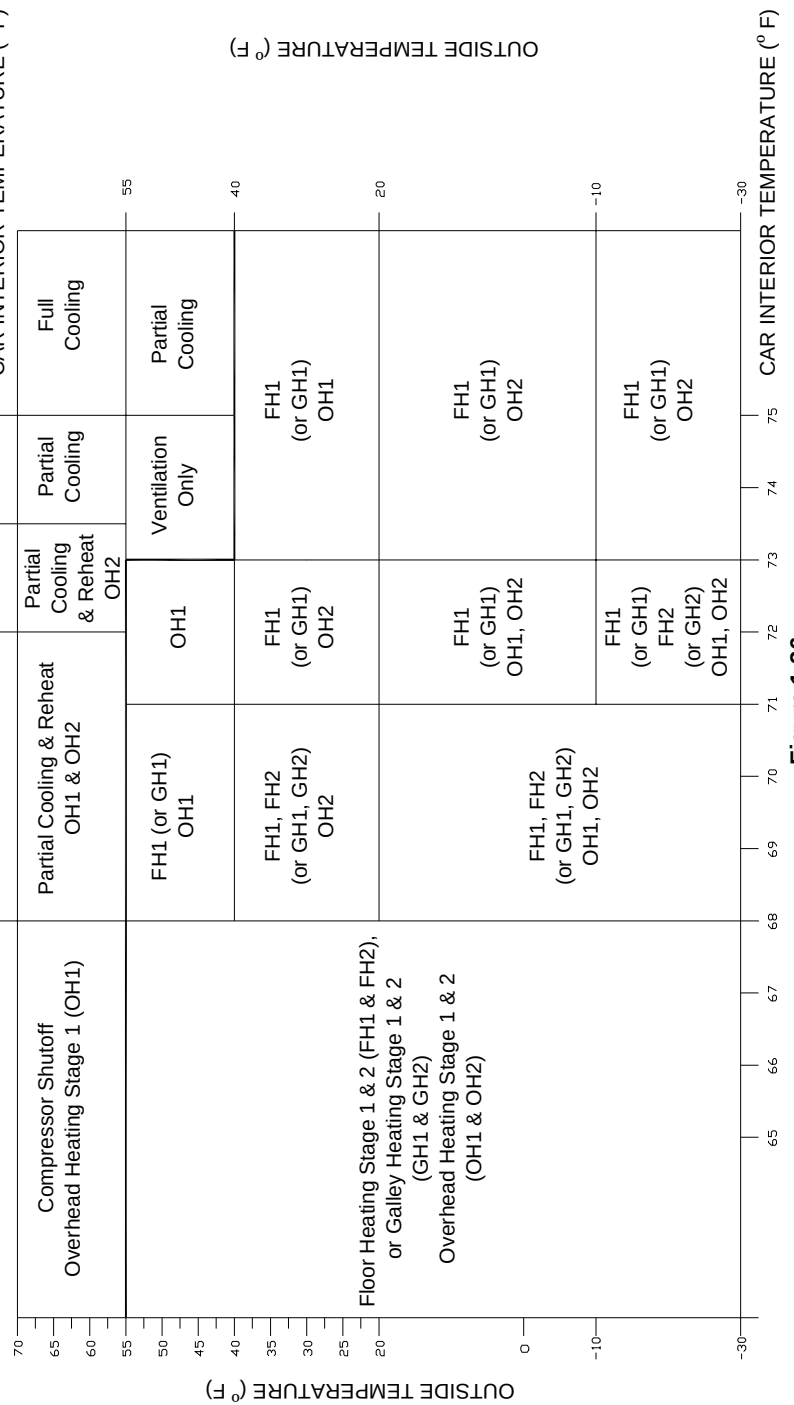


Figure 1-36
Passenger Car Temperature Control Chart

1.4.8.2 Intercom. Train crew members can communicate with each other by Intercom from the communication station. The engineer and assistant can use a headset or a microphone. Maintenance personnel can use one of the six remote stations located in the power car equipment room to communicate with the other remote stations, the engineer, or the assistant. Two remote stations can talk to each other at the same time. However, a remote station and a cab station cannot communicate at the same time.

IC transmission with the headsets is VOX activated. (There is no need to press on a PTT switch.) IC transmission without the headsets requires that the PTT switch be pressed (communication footswitch for the engineer and assistant's headset station PTT for the assistant).

From the communication station, the IC operation is the same as for the PA, but the audio is distributed among the other communication stations and in both power car cab speakers. Pressing the IC CALL button generates a coded tone sequence, heard in all interior speakers, that informs the crew that a member wants to use the IC function. To hear that IC message, the other crew members have to use a communication station and set it to IC mode.

1.4.8.3 Radio. For radio communication with the wayside on all AAR channels, the engineer can use the remote control head on the engineer's center console switch panel (the headset with the footswitch PTT or the console microphone with the footswitch PTT). The assistant can use the assistant's headset station, with the station PTT or the station microphone with the station PTT. The radio reception is heard from the remote control head speaker.

Radio communication is available in all cars by using a portable radio to transmit radio signals by means of the leaky feeder connected to the cafe car radio.

1.4.8.4 Attendant Call System. In all passenger cars, the activation of an attendant call button is reflected on all the bulkhead display signs of the local car. The attendant call annunciation panels, located in the cafe car, first class car and end coach car, show all the attendant call buttons activated in the trainset.

1.4.8.5 Entertainment System. The entertainment system provides audio and video services to the passengers. Five audio channels are simultaneously broadcast from the cafe car to every other car through the digital car network. The entertainment system is made of the following components:

- Video System: The video system comprises a Video Home System (VHS), a Digital Video Disk (DVD), and a selector panel. The video system has the capability to select one of the video signals and broadcast it to the cafe car video monitors.
- Compact Disk Player: Three players of the multichanger type (ten compact disks) are located in the crew office, as the video system.
- Video Monitor: Two video monitors are installed in the cafe car.
- Uninterruptable Power Supply: An Uninterruptable Power Supply (UPS) powers the cafe car video system and the TV monitors. To avoid interruption in VHS and DVD service and to avoid restarting the monitors at every phase break, the UPS ensures uninterrupted power for a maximum of one minute.
- Interior Speakers: Twelve hi-fi speakers are installed in every passenger car.

- Passenger Control Unit: The passenger control unit is installed in the armrest of each seat and at the ADA locations. Each unit receives five audio channels: three stereophonic (compact disc player) and two monophonic (DVD and VHS). All units are equipped with the following controls and features: HEADSET jack, CHANNEL selection pushbutton, VOLUME up pushbutton, VOLUME down pushbutton, and channel display.

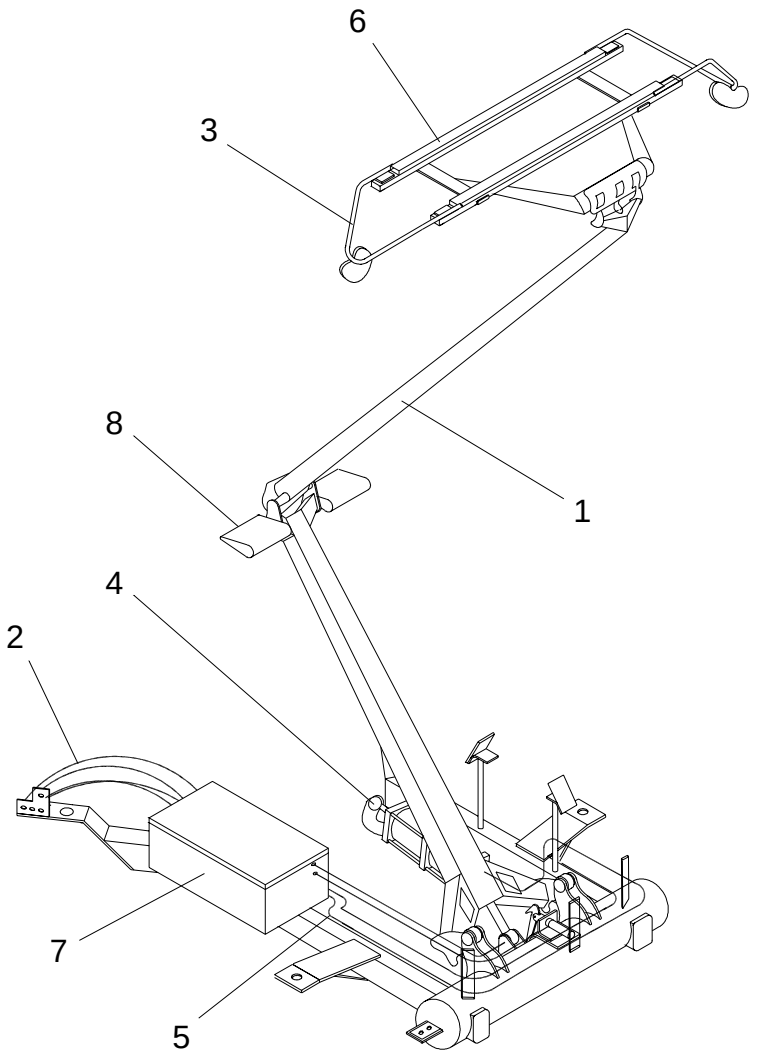
1.4.8.6 Passenger Information System. The passenger information system provides visual information including text messages and colored lights directed to passengers. The Multifunction Display Cafe (MFDB) is used to select messages and route appropriate sign (refer to Subsection 1.4.12, on page 1-71, "Train Monitoring and Data Management Systems" for more details). The communication control units manage the system that includes various types of signs. These are as follows:

- Bulkhead Display Signs: These signs are linked to toilet door lock switches to indicate if the toilets are available or not. The bulkhead display phone-toilet signs show phone availability (in use or hung up). A maintenance switch is provided in every toilet to indicate, both on the bulkhead display phone-toilet signs and the bulkhead display toilet-toilet signs, that the toilet is not in service.
- Exterior Display Signs: These signs, installed outside, display information to the passengers at a station.
- General Information Display Signs: These signs, installed at both ends of the passenger seating area of all cars, display general information to the passengers.
- Route Display Sign: These signs are installed in each passenger entry area and display the origin, destination, and route stops of the train.
- Seat Location Displays and Handheld Instrument: The seat location displays are located near each luggage rack reading light. They display the origin and the destination of every passenger, using the electronic passenger manifest, as received from the data management system. There is one display for each pair of seats in the coach car and end coach car. In the first class car, one display is supplied for each individual seat and each pair of seats. An infrared sensor is incorporated in the display to allow the conductor to change the display with a remote controller called the Handheld Instrument (HHI). The HHI interacts with every display using an 18-inch working distance infrared emitter. The HHI changes the information locally only. The changes are not reflected anywhere else.

1.4.9 PROPULSION AND ELECTRIC BRAKING. The propulsion system supplies electrical power to the traction motors, provides Head End Power (HEP), and controls electric braking power from the motors. The major components of the system are described in the following subsections.

Refer to Subsection 2.1.9, on page 2-58, "Propulsion and Electric Braking" for a description of the controls and indicators related to this system.

1.4.9.1 Pantographs (Fig. 1-37). Each power car has two pantographs located at the rear end of the car. The two pantographs are of the single-arm, direct-air-operated type. The collector head consists of two carbon strips, that contact the catenary and have sealed air passageways. With the pantograph in operation, the passageway is pressurized. With the carbon broken or missing, the air to the raising cylinder is vented, causing the pantograph to drop.



1. High-Speed Pantograph
2. Air Lines to Carbon Strips
3. Horn
4. Raising Cylinder
5. Air Lines to Raising Cylinder
6. Carbon Strip
7. Air Control Equipment Box
8. Air Foil

Figure 1-37
High-Speed Pantograph

The pantograph is raised by an air cylinder mounted between the base frame and lower arm. To keep the pantograph up, a magnet valve is energized by the 72 Vdc supply. When the magnet valve is deenergized, the air in the system is vented and the pantograph is lowered.

Manual control of the pantograph is achieved from the engineer's overhead switch panel PANTO UP and PANTO DOWN pushbuttons. Actuation of the PANTO UP pushbutton provides a momentary "up" trainline command through the propulsion network to all the pantographs in the trainset, regardless of the train configuration (1-x-1, or 1-6-1-1-6-1). This "up" command automatically raises the pantograph of each power car, according to how each PANTOGRAPH LOCAL SELECTOR is positioned.

The PANTOGRAPH LOCAL SELECTOR switch has five settings: OFF, FRONT, REAR, BOTH, and AUTO. Refer to Subsection 2.1.9.6, on page 2-60, "PANTOGRAPH LOCAL SELECTOR (Fig. 2-34)" for a detailed description of how it affects each power car pantograph configuration.

The Main Circuit Breaker (MCB) can close only after the pantograph is raised.

CAUTION:

The trainset must not be moved from electrified to non-electrified tracks or from non-electrified to electrified tracks unless the pantographs are down and pantograph selector is OFF.

1.4.9.2 Four-Function Unit. The four-function unit consists of the following equipment:

- Main Circuit Breaker: Closes automatically at power-up.
- Catenary Voltage Sensing Transformer: Indicates the state of the catenary voltage to the Propulsion Electronic Control Unit (PECU).
- Lightning Arrestor: Protects the main circuit breaker by providing lightning strikes a path to ground.
- Grounding Switch: Ensures safety and allows maintenance activities by grounding both sides of the main circuit breaker.

1.4.9.3 Main Transformer and Tap Changer. The main transformer is located undercar between the trucks. The configuration of the transformer primary is adjustable by the tap changer mounted on top of the low voltage battery charger.

1.4.9.4 Propulsion Electronic Control Unit (PECU). The Propulsion Electronic Control Unit (PECU) controls the propulsion system of each power car. It controls the direction and amount of power flow from the catenary to the two motor inverters and the auxiliary inverter. In traction mode, it controls the power flow from the catenary to the traction motors. In braking mode, it controls the power flow to the catenary if receptive, or, if not receptive, either to the auxiliary inverter or to brake resistors.

The PECU also controls the auxiliary inverter. The auxiliary inverter, fed by the DC-Link, produces a 1780 Vac, three-phase, 60 Hz output that the auxiliary transformer steps down to produce the Head End Power (HEP). The HEP (480 Vac, three-phase, 60 Hz) feeds all the high-speed trainset equipment.

Two types of power converter, rectifier bridges and inverters, convert between ac and dc power. These power converters, and the rheostatic chopper, are all controlled by the PECU, and are based on gate turnoff thyristors (GTOs). The direction and amount of power flow is controlled by the timing and sequencing in the operation of the GTOs.

The PECU consist in the following equipment:

- Two Main Processing Units, located in the propulsion electrical cubicle
- Four Control Devices (AGATE) located in the central block.
- Six Remote Input/Output Modules: Four located in the central block, two in the auxiliary block.

1.4.9.5 Traction Motors. There are four asynchronous ac traction motors on each power car, two per truck. These are 4-pole, squirrel-cage motors.

1.4.9.6 Auxiliary Transformer. The auxiliary transformer steps down the 1780 Vac, three-phase, 60 Hz auxiliary inverter output to provide the 480 Vac, three-phase, 60 Hz, HEP. The auxiliary transformer is located inside the main transformer assembly.

1.4.9.7 Grounding Equipment. High-voltage grounding is through carbon ground brushes, three on each side of an axle. Primary current from the main transformer (and auxiliary block) is returned to one side, and the other currents from the carbody, including those from the lighting arrestor, to the other side.

Low impedance resistors, placed between the carbody and the gearbox, are used as ground loss detectors.

1.4.9.8 Master Controller. The main components of the master controller are the reverser, throttle lever, and cruise control lever.

1.4.9.9 Key Card Reader. The key card reader consists of a card reading surface, a keypad, a green LED, a red LED, a beeper, and associated circuitry.

1.4.9.10 Key Card Reader Bypass Switch. One sealed bypass switch is provided, in the propulsion electrical cubicle, for use exclusively when a key card reader has failed and the power car needs to be operated.

1.4.9.11 Cab Display Unit. Each cab is equipped with three cab display units. The Primary Operating Display (POD) and Multifunction Display No.1 (MFD1) are on the engineer's Console. The Multifunction Display No. 2 (MFD2) is on the assistant's console.

1.4.9.12 Cooling Equipment. Two water pumps circulate a water/glycol mixture through two radiators in the central block.

Four central block blowers circulate air through the two radiators, across the snubbers, and out through the roof hood.

Two main transformer oil pumps circulate oil through the transformer radiators. Two main transformer blowers circulate air through the radiators, through the rheostatic grids, and out through the roof hood.

Forced air cooling is provided by two traction motor blowers. All pumps and blowers are powered by 480 Vac power.

1.4.9.13 EMI Limit Detector. The Electromagnetic Interference (EMI) Limit Detector is located in the electrical locker No. 2. Its sensor is also located in the locker, on the main return line. It cuts the feed to the main circuit breaker to open catenary power when the level of electromagnetic interference reaches a threshold.

1.4.9.14 Fire Suppression System. The central element of the fire suppression system is the fire suppression control box, which controls the FE13 extinguishing agent stored in a high-pressure container in the central block. The control box also sends signals to inhibit propulsion.

The fire suppression control box is located in the propulsion electrical cubicle. The other components are spread throughout the central and the auxiliary blocks.

An audio alarm and a cab console screen indication warn the engineer of a fire. The engineer may go to the equipment room and possibly initiate suppression there, or allow automatic suppression after a two-minute delay, or deactivate suppression.

CAUTION:

When the fire alarm is acknowledged, automatic fire suppression is inhibited.

1.4.9.15 High Voltage Power Removal. The auxiliary block key switch is used for safety in power equipment maintenance. It inhibits access to power blocks unless the pantograph and main circuit breaker have been grounded. Refer to Subsection 2.2.8, on page 2-162, "High Voltage Power - Turning Off and On (Fig. 2-97)" for a description on how to perform high voltage equipment grounding.

1.4.10 FRICTION BRAKE EQUIPMENT (Fig. 1-38 and 1-39). The high-speed trainset braking system is controlled by the automatic brake control lever in the active cab. The braking system blends electrical and electropneumatic braking. The friction brakes are applied by reduction of brake pipe pressure.

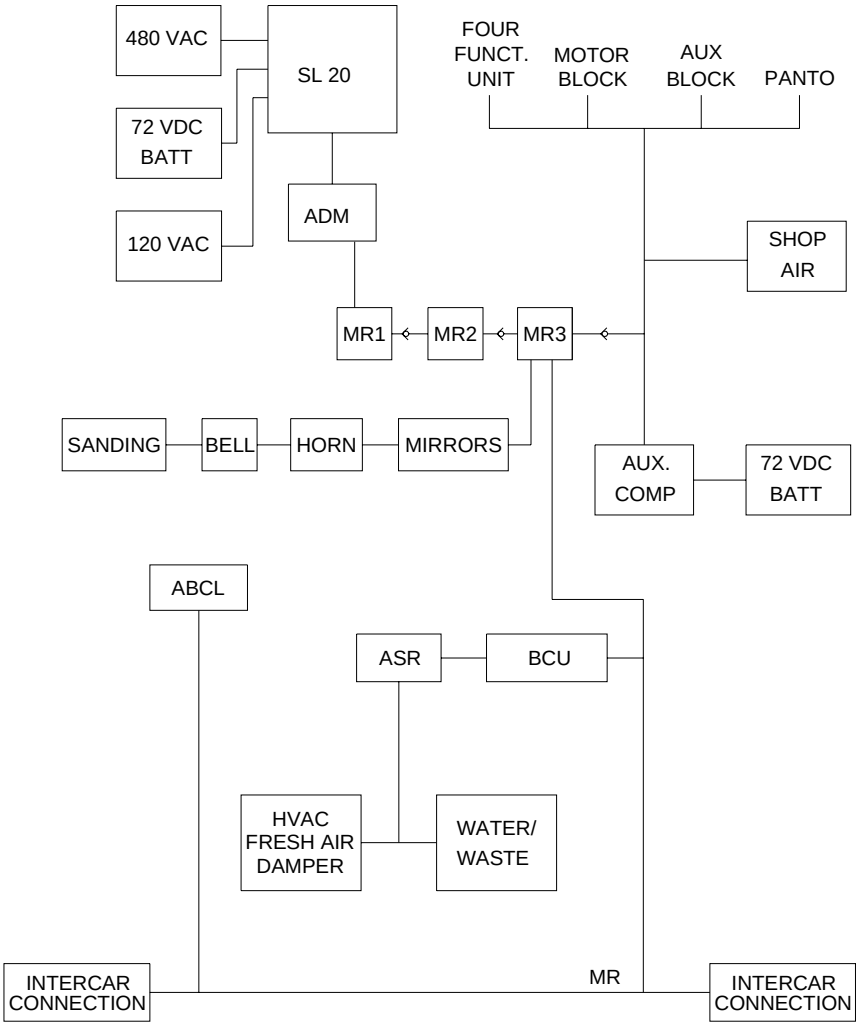
The friction brake system provides blended brake, pneumatic service brake, emergency brake, dead-in-tow feature by use of a tow locomotive, a snow brake feature, and spring-applied air release parking brake.

Refer to Subsection 2.1.10, on page 2-70, "Friction Brake Equipment" for a description of the friction brake equipment controls and indicators.

1.4.10.1 Blended Brakes. Trainset braking, when controlled by the automatic brake valve, results in the application of both the dynamic braking system and the air braking system. The blended brake system maintains a uniform braking rate using both the dynamic and air brake systems simultaneously. The blended system is designed to engage automatically whenever certain control system conditions are satisfied and the automatic brake valve handle is set to a service position.

The blended brake system makes full use of dynamic brake capability by using the maximum dynamic brake and supplementing this braking effort with air braking using dynamic braking during automatic brake operation results in less wear to the tread and disc brake components.

1.4.10.2 Air Brakes. In addition to dynamic brakes, the high-speed trainset is equipped with air operated mechanical brakes. The air operated system consists of both disc type and tread brake shoes mounted at each wheel.



ADM: Air Dryer Module

ASR: Auxiliary Supply Reservoir

SL 20: Air Compressor

Aux. Comp: Auxiliary Compressor

Figure 1-38
Air Supply Block Diagram

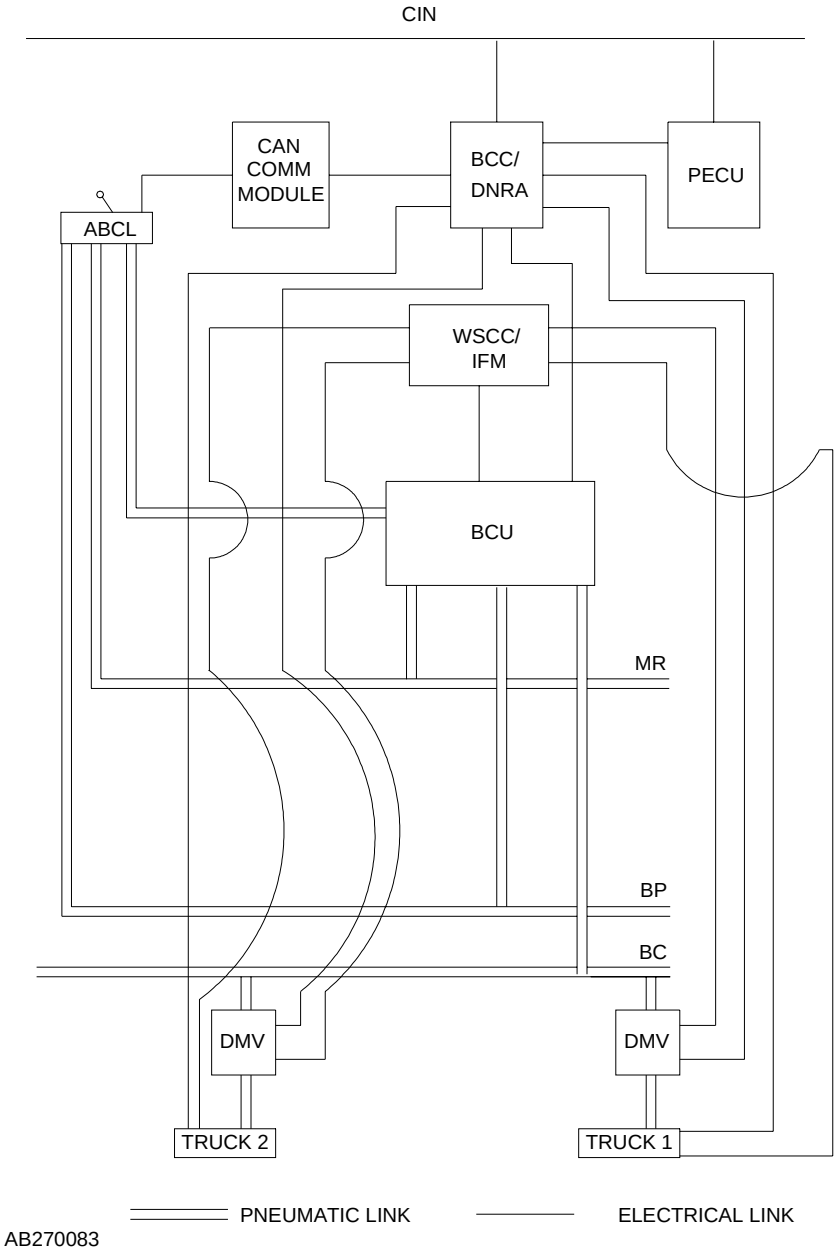


Figure 1-39
Air Brake System Block Diagram

The majority of the trainset air brake capability is provided by the disc brakes. The power car brake discs are bolted into a recess on each side of the wheel, the passenger cars brake discs are mounted on the axle. Composition brake pads on each side contact the disc when the air brakes are applied. Additional braking effort is provided by a cast iron tread brake shoe at each wheel.

1.4.10.3 Electrical Braking. Electrical braking occurs when power is generated by the traction motors and sent into the catenary for regenerative braking, and into braking resistors for rheostatic braking. The Brake Control Computer (BCC) communicates with the propulsion system to establish the level of electric braking and friction brake required to produce the required brake level.

1.4.10.4 Electropneumatic Braking. The electropneumatic braking (pneumatic application of friction brakes controlled electrically) is controlled by the Brake Control Computer (BCC). It can supply braking power from lite service to emergency braking. Friction brake effort is applied through discs and tread brake units at all axles.

1.4.10.5 Parking Brake. The parking brake is spring applied and air released. When no air is available, the parking brake can be manually released with the levers on both sides of the car.

WARNING:

A FALSE PARKING BRAKE APPLY INDICATION CAN OCCUR IF THE PARKING BRAKE IS APPLIED (USING THE PARKING BRAKE SWITCH ON THE ENGINEER'S RIGHT SWITCH PANEL OR THE PARKING BRAKE CUTOUT COCK ON THE BRAKE CONTROL UNIT) AND THE TRUCK MOUNTED PARKING BRAKE MANUAL OVERRIDE LEVER IS PULLED.

1.4.10.6 Snow Brake. The snow brake function prevents the buildup of snow and ice on the brake equipment of the power car. When energized, the snow brake function provides a friction brake application of 6 psi for 60 seconds at each of the disc and tread brake actuators.

1.4.10.7 Sanding. Sanding may be used when more adhesion between the wheel and rail is desired. Sand is ejected in front of the power car leading wheels. During an emergency brake application, sanding is automatic for 30 seconds or until the train stops, whichever is longer.

1.4.10.8 Air Supply. The power car air supply system main components are the air compressor, air dryer, main reservoir, brake supply reservoirs, and auxiliary reservoir.

1.4.10.9 Wheelslip/Slide System. All cars in the trainset feature a microprocessor controlled Wheelslip/Slide control system that detects and controls wheelslip on a per axle basis.

1.4.10.10 Truck-Mounted Brake System Components. The power car is equipped with four wheel-mounted cast steel brake discs. The passenger cars are equipped with three axle-mounted cast steel brake discs. All cars are equipped with four tread brake units, with automatic slack adjuster, per truck. The discs provide approximately 85% of the braking effort, and the tread brakes, 15%.

1.4.11 CAB SIGNAL AND AUTOMATIC TRAIN CONTROL SYSTEMS. The cab signal and automatic train control systems include the automatic train supervision/automatic train control/speed sensing system and the alerter/recorder system.

Refer to Subsection 2.1.11, on page 2-80, "Cab Signal and Automatic Train Control Systems" for a description of the controls and indicators related to these systems.

1.4.11.1 Automatic Train Supervision/Automatic Train Control/Speed Sensing and ACSES Systems. The Automatic Train Supervision/ Automatic Train Control/Speed Sensing system is a microprocessor-based cab signaling system. It emulates existing cab signal equipment, with the addition of expanded aspects, Advanced Civil Speed Enforcement System (ACSES) interface, and penalty brake suppression.

The automatic train supervision/automatic train control system provides the following:

- A continuously controlled and constantly visible speed-aspect cab signal, reflecting the coded information transmitted through the rails by the signal system.
- Automatic brake application and power removal if the engineer acknowledges a downward signal change, but fails to manually initiate braking after a specified period of time, and if the train speed exceeds the limit required by the new cab signal aspect.
- Full stop (penalty) brake application and loss of propulsion within 5 seconds, if the engineer fails to acknowledge a more restrictive cab signal speed indication.
- Cancellation of the brake application order, delayed by ATC system, when the train speed is at or below the level indicated by the cab signal speed aspect displayed, provided proper actions are taken by the engineer.
- An audible warning when the cab signal aspect changes to a lower speed aspect regardless of train speed and whenever the train is in overspeed.

The speed sensing system is used to process speed signals from two speed sensors associated with axles No. 2 and No. 3 of the power car. It also provides a visible display of the train speed on the Primary Operating Display (POD).

In the lead power car, the ATS/ATC/SS equipment is fully operational, and the speed sensing system provides the speed to the ACSES equipment, CIN network, and controls the no-motion and tilt enable relays. In addition, the cab signal is fully operational, the ADU is operational, and penalty brake can be applied from the lead ATS/ATC/SS system if required. In the trailing power car, the ATS/ATC/SS system is semi-operational. The speed sensing system provides the speed to the ACSES equipment, CIN network, and controls the no-motion and tilt relays. The cab signal is disconnected from its track receivers, and the ADU is turned off.

NOTE:

If two trainsets are coupled, each power car has its ATS/ATC/SS system in the state described above, depending on which cab is active.

1.4.11.2 ATC Wheel Calibration. The ATC wheel size calibration must be activated from the ATC unit. Once the ATC is put in wheel wear mode, it lets the user adjust the new size of all 4 wheels of a specific truck. The system permits the new settings to be selected between 40 in. and 38 in. with a step of 0.5 in.

1.4.11.3 Alerter/Recorder. The power car is equipped with a microprocessor based alerter/recorder system. This equipment performs the two functions described in the following subsections.

1.4.11.3.1 Alerter Operation. The alerter/recorder system alerter operation consists of a vigilance task that verifies the presence of the engineer upon periodic sequence.

The alerter/recorder monitors the cab console inputs. If, after a 25-second period of time the system has detected no inputs, it activates a blinking visual alarm and an audio alarm. The audio alarm consists of a one-second beep every 15 seconds. If after 15 seconds there is no acknowledgement, the audio alarm remains at maximum sound level. The alarm increases in intensity until a reset is activated. The engineer can activate a reset by doing one of the following:

- Activating the acknowledge footswitch
- Activating the acknowledge whisker switch
- Operating the horn button
- Operating the horn footswitch
- Operating the bell button
- Moving the automatic brake control lever.
- Moving the throttle.

NOTE:

If the ATC is cutout, the alerter can't be acknowledged by the acknowledge footswitch and acknowledge whisker switch. One of the other reset functions must then be used.

If the engineer does not activate a reset, the alerter/recorder activates a penalty brake combined with traction power removal. The engineer can reset the penalty brake condition by moving the brake handle to the suppression position. Once a penalty is initiated by the system, a full service brake application with power shutdown occurs.

1.4.11.3.2 Recorder Operation. The recorder task of the alerter/recorder system monitors and stores events over a 48-hour period. The recorder can also store up to ten minutes of cab background audio and radio audio activity.

The events recorded are:

- Speed
- Direction of motion
- Time
- Distance
- Throttle operation
- Brake application, and operation including dynamic brake
- Cab signal aspects and acknowledgment

- Civil speed enforcement display and acknowledgment
- Traction motor current
- Cutout (ITSU, ARU, ATC, ACSES, SS)
- Alerter system operation
- Horn-bell-headlights
- Loss of traction power
- Position/impact sensor operation
- Voice radio channel
- Cab background noise
- Parking brake status
- Out-of-limits of rail signal amplitude.

Refer to Subsection 2.1.11.8, on page 2-84, "Alerter/Recorder Equipment (Fig. 2-45)" for a description of the Alerter/Recorder System equipment.

1.4.12 TRAIN MONITORING AND DATA MANAGEMENT SYSTEMS. The train monitoring system monitors most trainset subsystems and provides a human interface through the display terminals in the cab (POD, MFD1, MFD2) and in the cafe car (Multifunction Display Cafe - MFDB). It also interfaces with the Data Management System (DMS).

The data management system is an onboard management computer acting as a gateway to a wireless radio network for transfer of train systems data to wayside maintenance and operations facilities. It also provides gateway functions for several onboard passenger services. The DMS is located in the crew office of the cafe car. The intercar communication is done using the monitoring network. The network is used to transmit maintenance events, subsystem statuses, alarms, extraordinary data report files and incoming train order files.

Refer to Subsection 2.1.12, on page 2-87, "Train Monitoring and Data Management Systems" for a description of the controls and indicators related to these systems.

1.4.12.1 Train Network. All vehicles in the trainset communicate through two monitoring networks. All intercar messages are sent on both networks. This ensures proper message delivery even if one network becomes inoperative. Beside providing intercar communication, the network is responsible for establishing the physical train configuration (vehicle position and orientation within the train consist).

1.4.12.2 Car Internal Network. The Car Internal Network (CIN) is used to carry monitoring and cab display information between subsystems in a car. The CIN is used for subsystems-to-Train Monitoring System, and Train Monitoring System-to-DMS communications. The CIN allows subsystem to subsystem communication (example: brake to propulsion). It also allows communications between the following components:

- Monitored subsystems equipped to communicate on the CIN
- Car Monitoring Unit (CMU)

- Display units located in the power car and cafe car
- CIN router located in the power car only.

The monitored subsystems not equipped to communicate on the CIN are directly linked to the CMU through discrete digital input lines.

1.4.12.3 Car Monitoring Unit. A Car Monitoring Unit (CMU) is found in each car. It has the following functions:

- Monitor the car subsystems through the CIN.
- Monitor non-MBS through discrete digital input lines.
- Manage the configuration of the train (car number, location and orientation).
- Provide network statistics and status.
- Enable intercar communication through the networks interface.
- Send/receive wayside information through the DMS.
- Drive line printer(s).
- Perform control functions (horn sequencing, ditch light flashing, etc.).

Each CMU is responsible for maintaining the trainset configuration.

1.4.12.4 Propulsion and Brakes Internal Network. The propulsion and brake internal network is used for communication between the propulsion and brake computers.

1.4.12.5 Car Internal Network Router. The car internal network router is the bridge that connects the propulsion and brakes internal network with the CIN to allow communication between the two networks.

1.4.12.6 Cab Display Units. Each power car cab is equipped with three Cab Display Units (CDU): Primary Operating Display (POD), and Multifunction Display No. 1 (MFD1) on the engineer's Console; Multifunction Display No. 2 (MFD2) on the assistant's console.

The cafe car is equipped with one display unit, Multifunction Display Cafe (MFDB). It is used as the interface to display operation/monitoring to the crew/maintenance personnel. It has the same characteristics and feature as the power car CDUs.

The CDUs are used as the user interface to display operation/monitoring information to the crew/ maintenance personnel.

1.4.12.7 Printers. The CMU provides interface to the power car cab printer on which are printed train orders.

1.4.12.8 DMS Data Radios. Two independent data radios, RAM and CDPD, are used to communicate with wayside operations and maintenance facilities using existing commercial wireless networks. The DMS accesses the network using either the RAM or CPDP data radio according to signal availability, message priority, and cost per packet of information. Each data radio is connected to an antenna located on the roof of the cafe car.

1.4.12.9 Workstation. The crew office in the cafe car is equipped with a laptop computer called the workstation. Most passenger related services are either applications running on the workstation, or are peripheral devices connected to it.

1.4.12.10 DMS Interfaces. The data management system interfaces with the equipment described in the following subsections.

1.4.12.10.1 CIN Interface. The DMS interfaces with the CIN to communicate with the CMU, MFDB, and Bistro Communication Control Unit (BCCU, cafe car). It uses the interface to the local CMU to exchange intercar information over the Monitoring Network (MNET).

1.4.12.10.2 CMU Interface. The DMS exchanges the following information with the Car Monitoring Unit (CMU):

- DMS system operational status
- Extraordinary Data Report file requests
- Extraordinary Data Report files
- Subsystem maintenance events
- Overall trainset health status
- Date and time set commands.

1.4.12.10.3 MFDB Interface. The DMS exchanges the sign control free text input message with the Multifunction Display Cafe (MFDB, cafe car).

1.4.12.10.4 BCCU Interface. The DMS exchanges the reduced passenger manifest file with the Bistro Communication Control Unit (BCCU, cafe car):

1.4.12.10.5 Workstation Interface. The DMS exchanges the following information with the Workstation:

- Sign control free text input message
- Reduced passenger manifest file
- Arrow passenger manifest file
- Arrow reservation system messages
- Commissary report files
- Extraordinary Data Report file requests
- Extraordinary Data Report files.

1.4.12.10.6 Data Radios Interface. The DMS also provides an interface with the two independent data radios in order to access the wireless networks. The wireless networks are used by the DMS to establish data links between the train and wayside facilities. The DMS exchanges the following information with the data radios:

- Subsystem maintenance events
- Overall trainset health status
- Date and time set commands

- Arrow passenger manifest file
- Arrow reservation system messages
- Extraordinary Data Report file requests
- Extraordinary Data Report files.

The following table describes in which direction the DMS data is sent on the wireless networks.

Table 1-2
DMS Data Direction

APPLICATION	DATA DIRECTION - TRAIN-WAYSIDE
Arrow Reservation	Both Directions
Passenger Manifest (Arrow Format)	Wayside to Train
Maintenance Event	Train to Maintenance Facility Server
Extraordinary Data Reporting	Train to Maintenance Facility Sever
Train Order	Operating Center to Train
Train Heartbeat (Health Status)	Train to Maintenance Facility Server

1.4.12.10.7 Printer Interface. The DMS interfaces with a thermal printer in the cafe car crew office. The printer is used to print files such as:

- Train orders
- Passenger manifests
- Commissary reports.

1.4.12.11 DMS Operation. The DMS has no user interface. It acts a router for maintenance data and passenger related services data. It transmits monitoring information from the CMU to maintenance facilities, and performs the following:

- Data Radio Control
- Passenger Services
- Trainset Sign Control
- Train Order Handling
- Extraordinary Data Reports Handling.

1.4.12.12 Extraordinary Data Report Files. Extraordinary Data Report (EDR) file requests can be initiated by a wayside maintenance facility, or by an application running on the crew office workstation. The request is comprised of the car number, target subsystem and file index number. In response to an EDR file request,

the target subsystem controller initiates a file transfer. The EDR file is transferred to the DMS. The DMS then routes the file to the crew office workstation or one of the wayside maintenance facility.

The workstation has an application for viewing extraordinary data reports. The application provides a menu for selecting the car, subsystem, and file index.

1.4.12.13 Subsystem Maintenance Events. All microprocessor subsystems generate maintenance events, used as diagnostics for system troubleshooting. Each event is stored in the subsystem internal memory. The maintenance event is sent to the car CMU that transfers the event to the DMS. The appropriate data radio is chosen and the maintenance event message is forwarded to the wayside maintenance facility.

1.4.12.14 Overall Trainset Health Status. The cafe car CMU compiles and generates an overall trainset health status message. This status includes the physical configuration of the trainset (car numbers and orientation), geographical position and an indicator of major on-board subsystem health. The DMS transfers this status to the wayside operation and maintenance centers.

1.4.13 WATER AND WASTE RETENTION SYSTEMS. The water and waste retention systems are divided into two subsystems: Water supply system and waste retention system.

- The water supply system delivers, holds, controls or drains all the fresh water supply available in the high-speed trainset.
- The waste retention system includes all the components that retain, or move waste.

Refer to Subsection 2.1.13, on page 2-121, "Water and Waste Retention Systems (Fig. 2-89 to 2-91)" for a description of the controls and indicators related to these systems.

1.4.13.1 Water Supply System. The water supply system comprises the equipment described in the following subsections.

1.4.13.1.1 Water Tank. Each passenger car has one 115-gallon water tank The cafe car has an additional one, for a total water capacity of 230 gallons.

In the power car, the cold water tank located in the toilet module has a capacity of 7.5 gallons. The water is distributed by gravity to the toilet and sink.

1.4.13.1.2 Hot Water Heater. The hot water heater provides one gallon of water heated at 120 °F. There are two hot water heaters in each coach car, one for each toilet room. The first class car and end coach car also have another one for the galley. There is an additional one in the cafe car for the galley. Each tank is equipped with a vacuum relief valve, a pressure relief valve, heat pad, insulation, adjustable thermostat, and an over temperature cutoff set at 140 °F.

1.4.13.1.3 Water Cooler. In each passenger car, a water cooler provides 5 gallons per hour of water at 50 °F. There is one water cooler in each passenger car, on the right side at the A-End.

1.4.13.1.4 Water Fill Stations and Fittings. The water tank can be filled from either side of the car from an external source. The fill point consists of a box with a protected cover containing a hose fitting.

1.4.13.1.5 Water Raising Unit. All cars are equipped with a water raising unit located undercar. The raising system supplies enough pressure to raise water from tanks to car interior. It also provides pressure to move water through car piping.

1.4.13.1.6 Water System Protection. The water system is freeze-protected to enable the trainset to be left off power indefinitely in subfreezing temperatures. All water lines are equipped with manual and automatic drain valves. The freeze-protection is fully automatic, opening and closing the drain valves when required. The system is also protected against contamination with a backflow preventer.

1.4.13.2 Waste Retention System. The waste retention system comprises the equipment described in the following subsections.

1.4.13.2.1 Toilet (Fig. 1-40). The power car toilet is designed as a self-contained unit. It comprises a flush control and isolation valve and a flush control unit.

Each passenger car is equipped with and ADA toilet room. The coach car is also equipped with a conventional toilet. Each toilet is designed as a self-contained unit. It comprises a flush control valve, a control valve assembly, a flush control unit (FCU), and a valve discharge fitting.

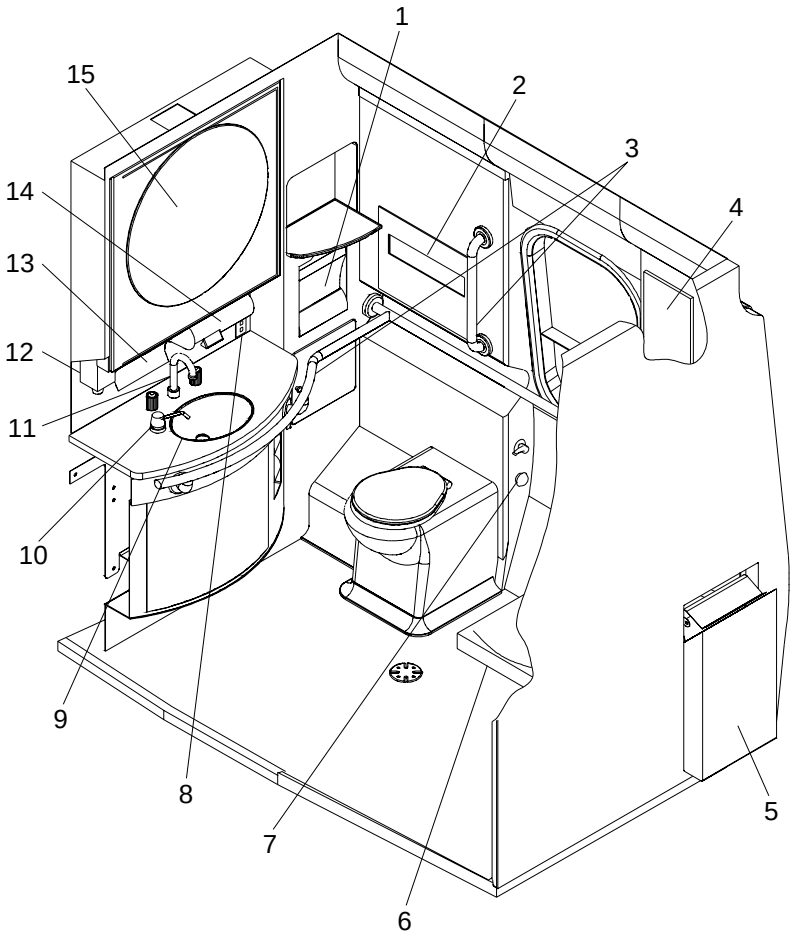
The equipment of the ADA toilet is detailed on Figure 1-40.

1.4.13.2.2 Waste Tank. The power car waste tank has a capacity of 15 gallons, with approximately 6 gallons of retention capacity in the drainage piping system.

The passenger car waste tank assembly stores the waste that is drawn by vacuum from the toilet assembly. It has a capacity of 90 gallons and is located undercar.

1.4.13.2.3 Water Pressurizer. In the power car, a water pressurizer provides toilet rinsing water at required pressure to the toilet flushing system.

1.4.13.2.4 Undercar Service Line. In all passenger cars, the undercar service line provides external access to waste tank for the purpose of draining and rinsing the tank. The quick-disconnect fittings are accessible from either side of the car to interface with the servicing facility.



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1. Trash Receptacle
2. Toilet Seat Cover Dispenser
3. Grab Handle
4. Mirror
5. Diaper Trash Receptacle
6. Infant Changing Table
7. Attendant Call Button
8. Electrical Outlet
9. Sink
10. Soap Dispenser
11. Faucet
12. Paper Cup Dispenser
13. Paper Towel Dispenser
14. Hand Dryer
15. Back Lit Mirror

Figure 1-40
ADA Toilet Room Equipment

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CHAPTER 2
OPERATING INSTRUCTIONS

This chapter contains the instructions needed by the train crew to effectively and efficiently use the equipment.

SECTION 2.1
CONTROLS AND INDICATORS

This section describes and explains how to use all the controls and indicators available to the crew for every system in the trainset.

2.1.1 CARBODY, INTERIOR FIXTURES, OPERATING CAB (Fig. 2-1 to 2-5).
The following controls and indicators are located in the power car cab:

- INT. WIPER DELAY: This knob, on the engineer's center console switch panel, controls the wipers delay when the WIPER (PUSH TO WASH) switch is in the INT. position.
- WIPER (PUSH TO WASH): This switch, on the engineer's center console switch panel, activates the wipers. It can be placed in INT. (intermittent), OFF, LO, or HI positions. Washing liquid is sprayed on the windshield when the switch is pushed.
- ADJUSTABLE FOOTREST: This switch, below the engineer's center console switch panel, operates the adjustable footrest (up or down).

NOTE:

If the switch is defective, the adjustable footrest can be adjusted manually.

- MIRRORS (PUSH TO RETRACT): This switch, on the engineer's desk right switch panel, spreads the corresponding mirror out when OUT LEFT or OUT RIGHT is selected. It retracts the mirrors when pushed. The mirrors retract automatically when the power car speed reaches 3 mph. When the trainset is at speed, the mirrors can be extended momentarily by holding the switch in OUT position.

WARNING:

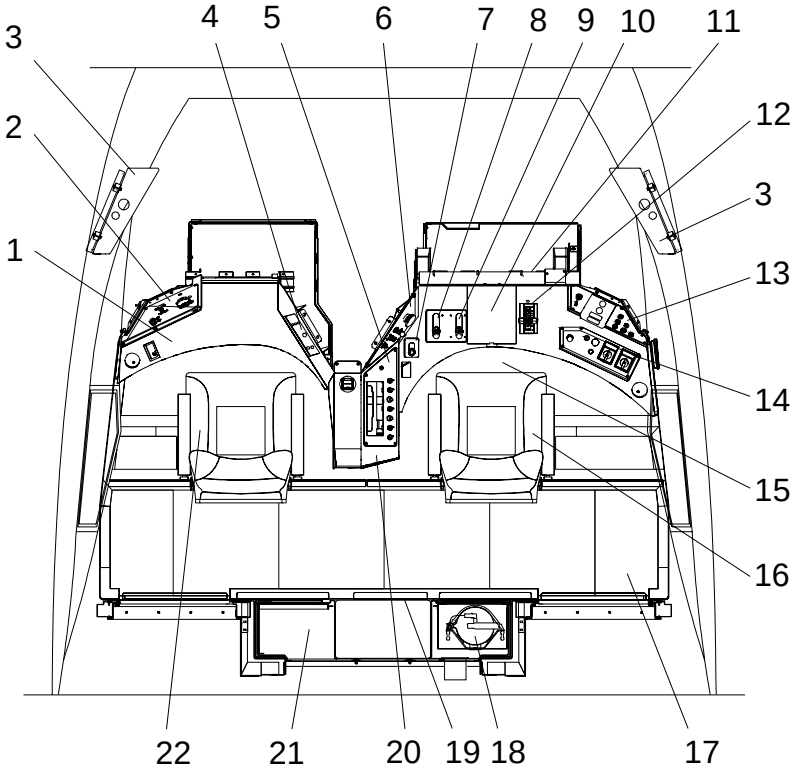
THE TRAINSET IS BEYOND NORMAL CLEARANCE WHEN THE MIRRORS ARE EXTENDED.

- HORN: These levers, on the engineer's desk right switch panel and on the assistant's left switch panel, activate the horn. Two sound levels are provided: LOW and HIGH. When the horn is activated, the bell automatically starts ringing and can only be stopped by pressing the BELL pushbutton.

NOTE:

The horn footswitch activates the horn if the train speed is 3 mph or more. When the footswitch is pressed down, the horn starts a blast sequence, two long followed by one short and one long. It also starts the bell and flashing ditch lights.

- SAND: This pushbutton, on the engineer's desk right switch panel, activates sanding. The sand is released as long as the pushbutton is kept pressed.
- BELL: This pushbutton, on the engineer's desk right switch panel, activates the bell. When the bell ring is initiated by activation of the horn, the BELL pushbutton has to be pressed to stop the bell.



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1. Assistant's Console, with Multifunction Display No. 2 (Fig. 2-53)
2. Assistant's Left Switch Panel (Fig. 2-4)
3. Retractable Mirror
4. Assistant's Headset Station (Fig. 2-29)
5. Engineer's Center Console Switch Panel (Fig. 2-2)
6. Engineer's Left Switch Panel (Fig. 2-11)
7. Reverser (Fig. 2-36)
8. Cruise Control Lever (Fig. 2-36)
9. Throttle Lever (Fig. 2-36)
10. Engineer's Console, with Primary Operating Display (Fig. 2-47) and Multifunction Display No. 1 (Fig. 2-49)
11. Engineer's Overhead Switch Panel (Fig. 2-10)
12. Automatic Brake Control Lever
13. Engineer's Right Switch Panel (Fig. 2-5)
14. Engineer's Desk Right Switch Panel (Fig. 2-3)
15. Adjustable Footrest (Fig. 2-93)
16. Engineer's Seat (Fig. 2-92)
17. Cab Refuge
18. Fire Extinguisher
19. Cab Wall, with Cab Rear Wall Switch Panel (Fig. 2-9)
20. Remote Control Head (Fig. 2-28)
21. Emergency Equipment, Toolbox and First Aid Kit
22. Assistant's Seat (Fig. 2-92)

Figure 2-1
General Cab Layout

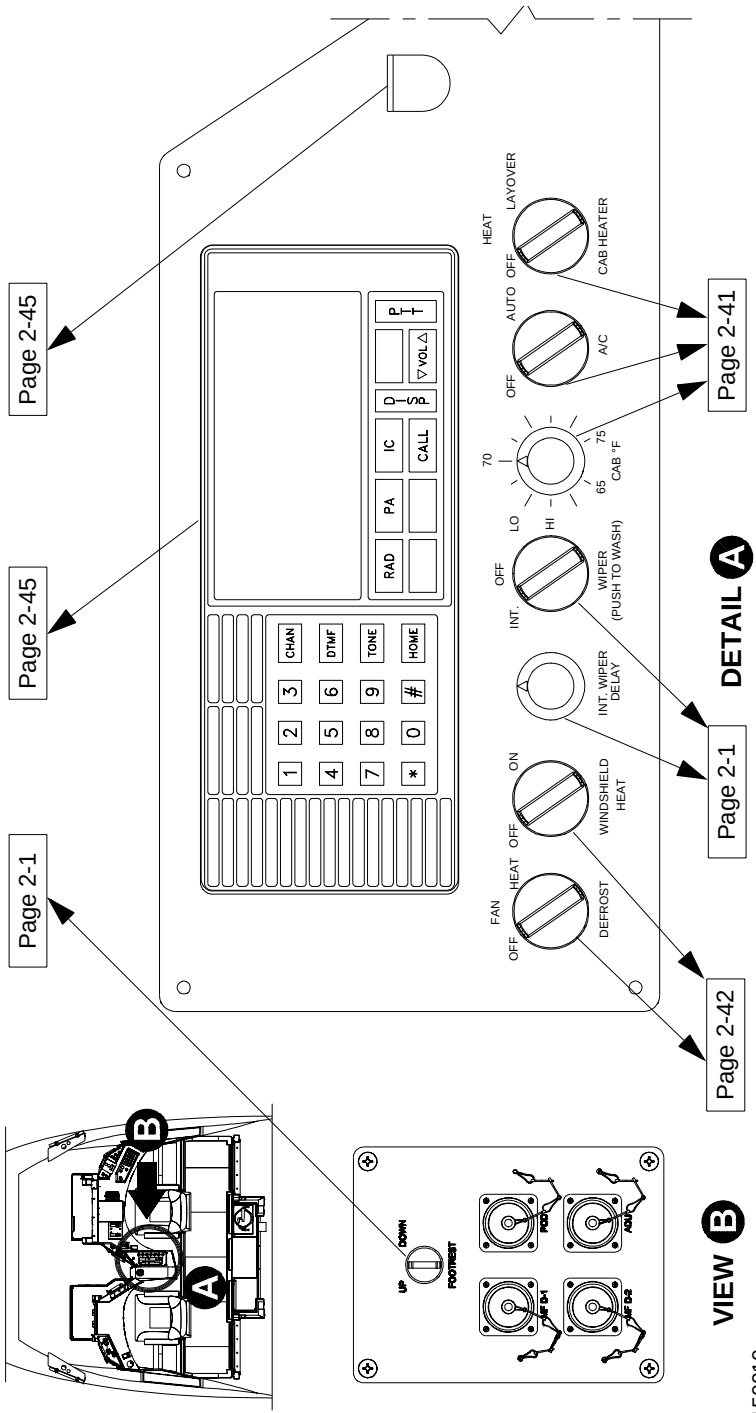


Figure 2-2
Engineer's Center Console Switch Panel and Adjustable Footrest Switch Panel

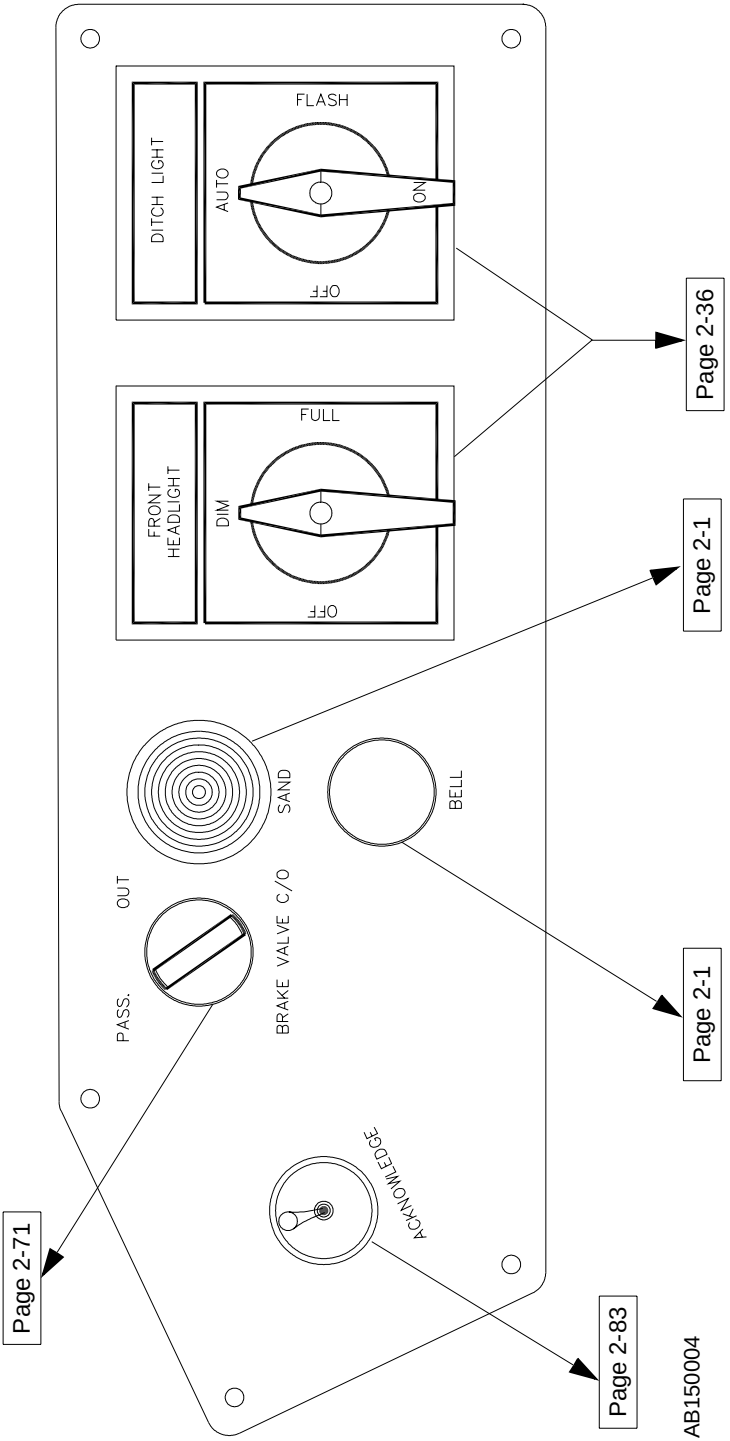


Figure 2-3
Engineer's Desk Right Switch Panel

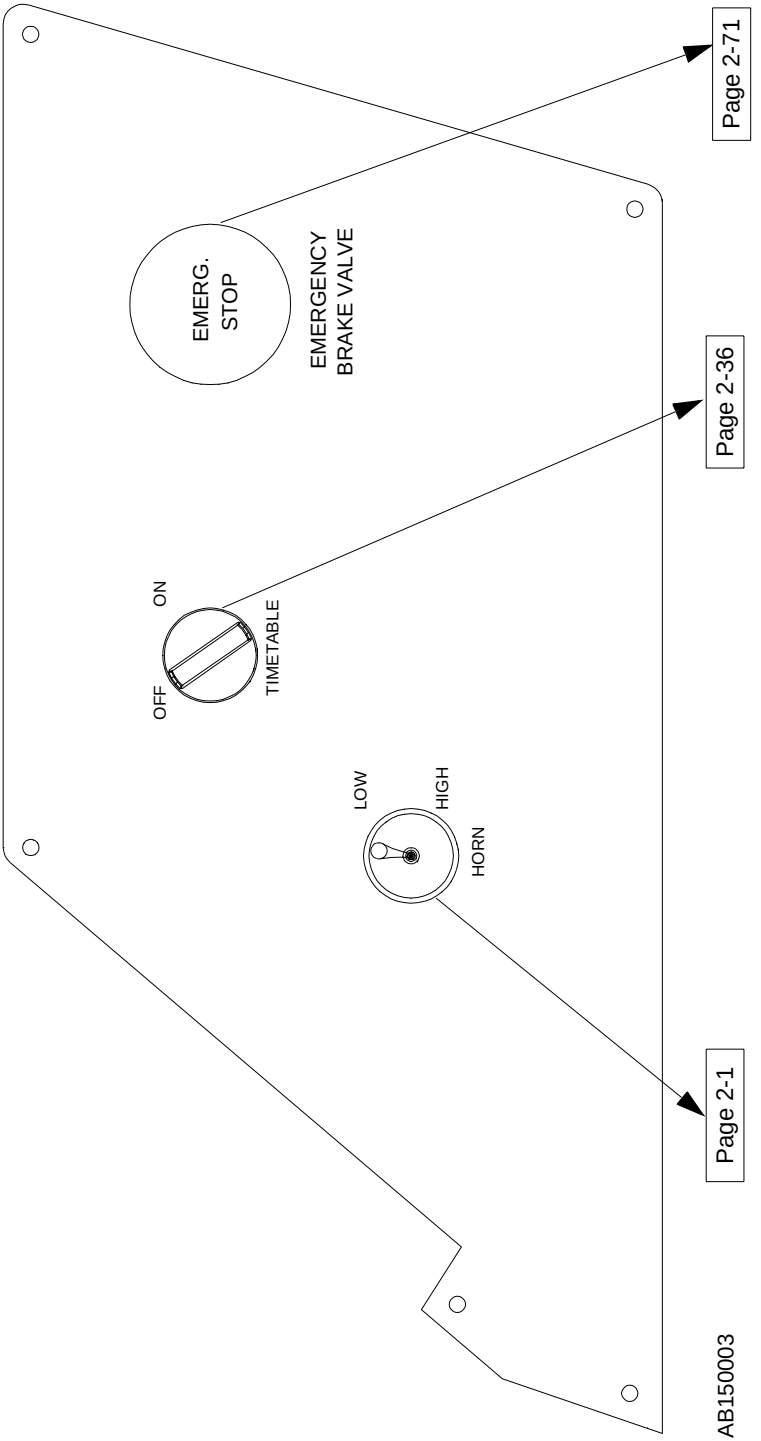


Figure 2-4
Assistant's Left Switch Panel

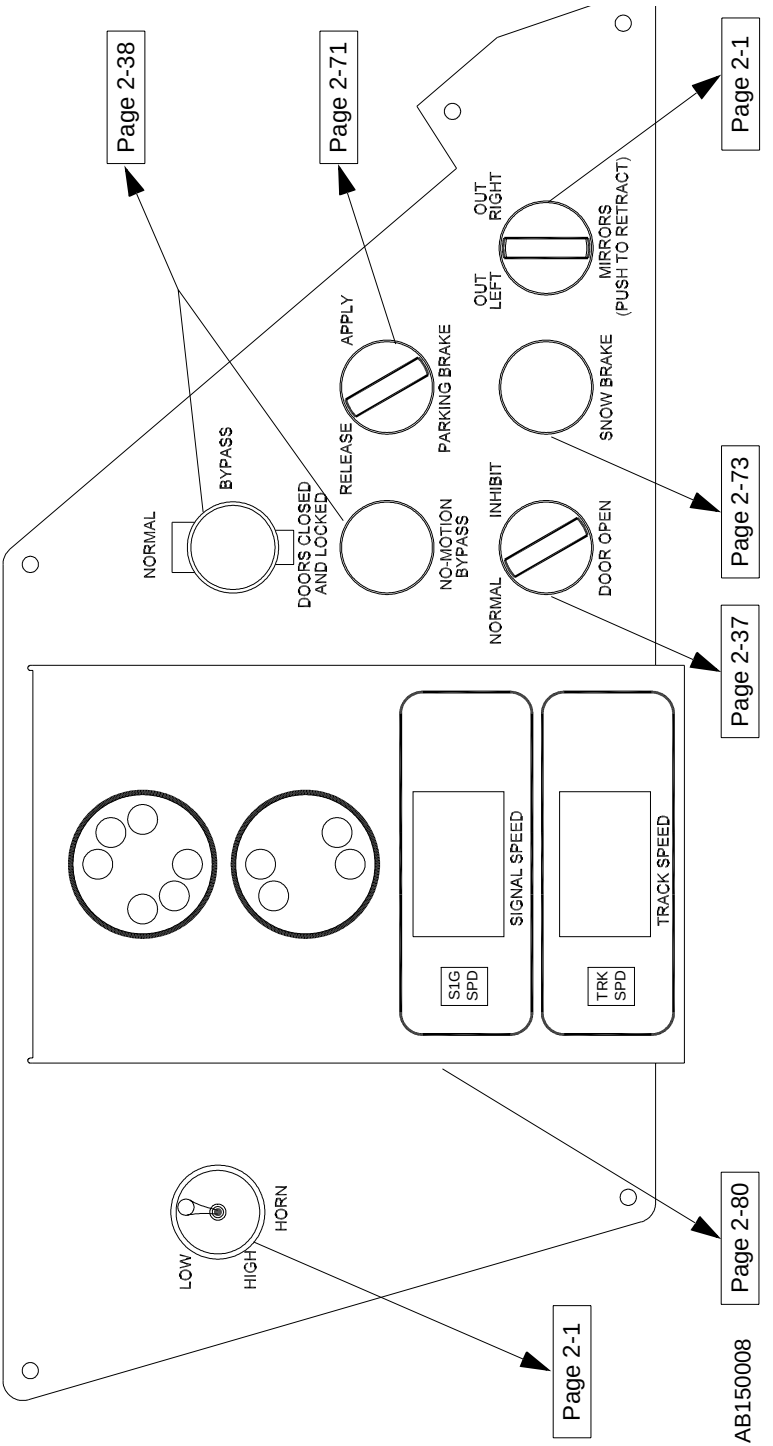


Figure 2-5
Engineer's Right Switch Panel

2.1.2 TRUCK AND SUSPENSION. This section lists the main components of the truck assembly and describes the controls and indicators of the integrated truck surveillance system and the tilting system.

2.1.2.1 Truck Assembly (Fig. 2-6 and 2-7). The main components of the power car truck are:

- Truck frame
- Parking brake manual override lever
- Wheel-mounted brake disc
- Tread brake unit
- Traction motor (each with its own speed sensor)
- Gear unit (with ATC and wheelslip/brakes, or ACSES and wheelslip/brakes speed sensor)
- Power coupling
- Traction bar.

The figure also shows the location of the service chains and the red lifting chains that are used for lifting the power car only.

WARNING:

THE TRAINSET MUST NOT BE OPERATED WHEN THE RED LIFTING CHAINS ARE INSTALLED. ALWAYS CHECK THAT THE SERVICE CHAINS ARE IN PLACE PRIOR TO TRAINSET OPERATION.

The only controls available to the operating crew are the parking brake manual override levers located at each corner of the truck.

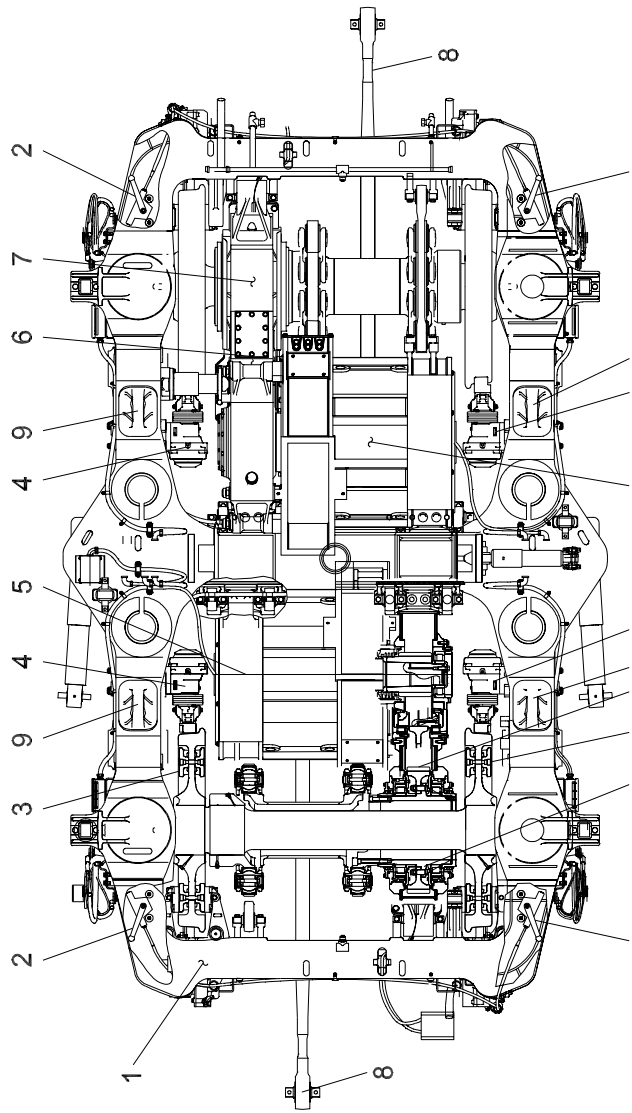
The various speed sensors mounted on both trucks are as follows:

- The traction motor speed sensors No. 1 to No. 4 are mounted on their respective traction motors.
- ACSES and wheelslip/brakes speed sensors are mounted on the gear units of axles No. 1 and No. 4.
- ATC and wheelslip/brakes speed sensors are mounted on the gear units of axles No. 2 and No. 3.

The main components of the passenger cars truck main components are:

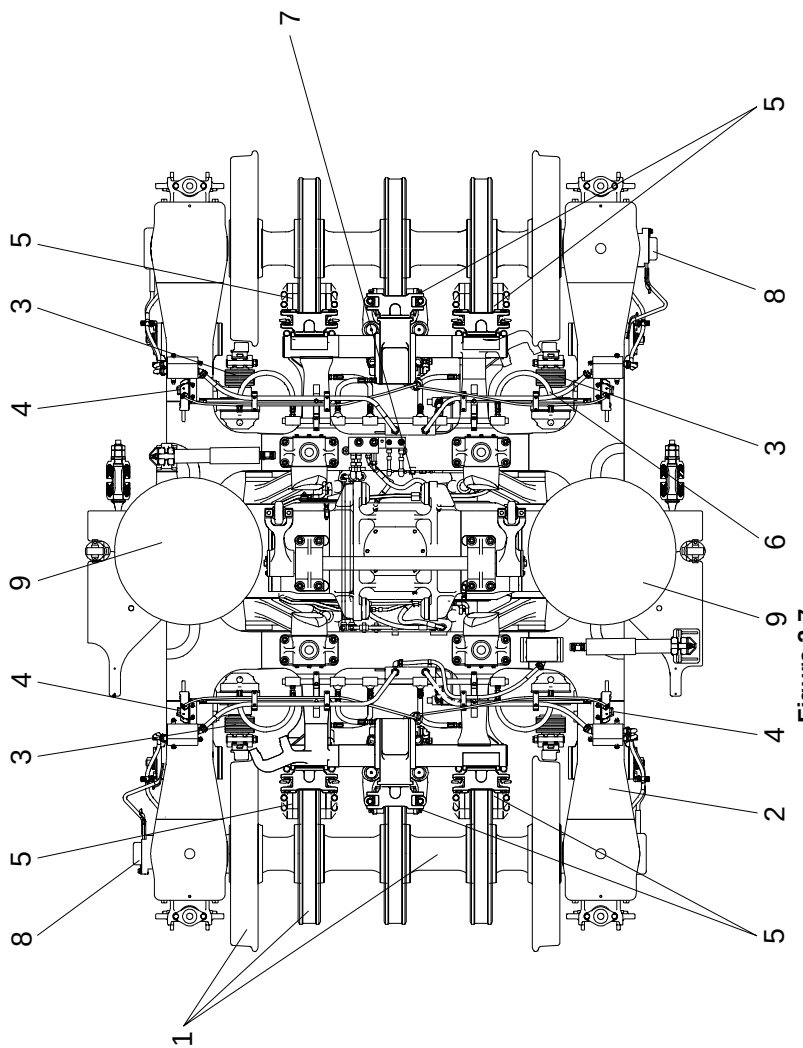
- Truck frame
- Tread brake unit
- Parking brake manual override lever
- Disk brake unit
- Secondary suspension air bag
- Tilting bolster.

In each case, the only controls available to the operating crew are the parking brake manual override levers located at each corner of the truck.



1. Truck Frame
2. Parking Brake Manual Override Lever
3. Wheel-Mounted Brake Disc
4. Tread Brake Unit
5. Traction Motor, with Speed Sensor
6. Gear Unit, with ATC/Brakes, or ACSES/Brakes Speed Sensor
7. Power Coupling
8. Traction Bar Assembly
9. Service Chain or Lifting Chain (Red)

Figure 2-6
Power Car Truck - Main Components



1. Wheel Set
2. Truck Frame
3. Tread Brake Unit
4. Parking Brake Manual Override Lever
5. Disk Brake Unit
6. Pneumatic Piping
7. Hydraulic Piping
8. Sensor
9. Air Bag

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Figure 2-7
Passenger Car Truck - Main Components

2.1.2.2 Integrated Truck Surveillance Unit (Fig. 2-8). The following control and indicators are located on the Integrated Truck Surveillance Unit (ITSU), mounted on each car electrical locker (electrical locker No. 1 in the power car):

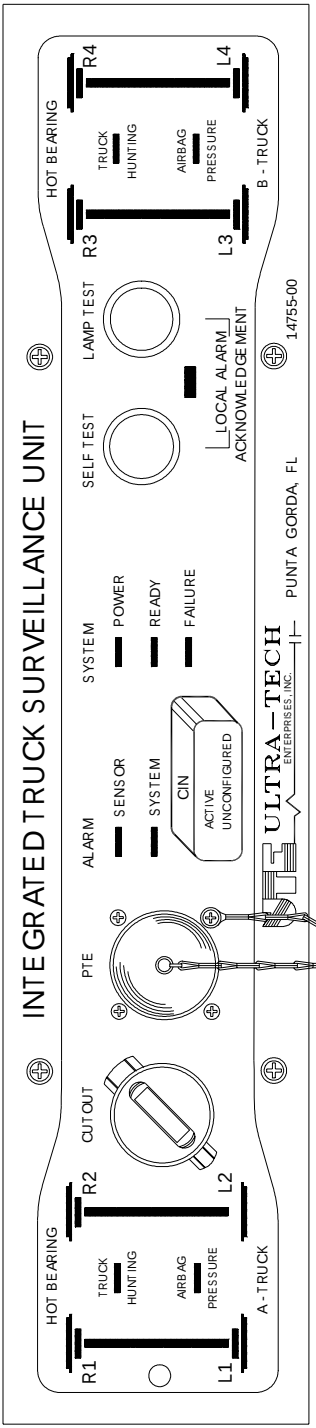
- HOT BEARING: These LEDs operate as follows for each wheel: green, normal operation; flashing red, hot bearing alarm; flashing amber, temperature sensor failure; steady amber, temperature sensor bypassed.
- TRUCK HUNTING: These LEDs operate as follows for each wheel: green, normal operation; flashing red, truck hunting; flashing amber, accelerometer failure; steady amber, accelerometer bypassed.
- AIR BAG PRESSURE: These LEDs operate as follows for each truck: green, normal air bag pressure; flashing red, air bag deflated; flashing amber, sensor failure; steady amber, sensor bypassed. In the power car, these LEDs remain unlit, as there are no air bags on the power car trucks.
- CUTOUT switch: This sealed switch cuts out the ITSU when activated.
- PTE Connector: This connector is used to connect the portable test equipment.
- ALARM: The red SYSTEM LED indicates a system failure. The amber SENSOR LED indicates a sensor failure.
- CIN: These LEDs indicate the Car Internal Network (CIN) port status, UNCONFIGURED in red, and ACTIVE in green.
- SYSTEM: The POWER, READY, and FAILURE LEDs indicate the system status.
- SELF TEST switch: This pushbutton activates the self-diagnostic test.
- LAMP TEST switch: This pushbutton activates a lamp test that verifies the proper functioning of all ITSU indicators.
- LOCAL ALARM ACKNOWLEDGMENT: A LED indicates if the system is in a degraded mode of operation (any sensor bypassed).

2.1.2.2.1 ONBOARD TL Switch (Fig. 2-9). The ONBOARD TL switch, on the cab rear wall switch panel, is used to recover trainset operation when the ITSU sealed CUTOUT switch fails.

2.1.2.2.2 ONBOARD FAILURE Indicator (Fig. 2-10). The ONBOARD FAILURE indicator, on the engineer's overhead switch panel, is a red indicator topped by a green indicator. These indicators provide the following information:

- The red indicator turns on when an alarm, such as hot bearing, truck hunting, equipment room fire, or a car not centered properly, is initiated by the integrated truck surveillance system. It also turns on when a fire is detected.
- The green indicator is on when there are no onboard failures. It must always be on in normal operating conditions.

2.1.2.3 Tilting System. The tilting system controls and indicators available to the train crew are the TILTING switch, the centering detection cutoff switch, the tilting master controller and the tilting car controller.



HOT BEARING, TRUCK HUNTING, and AIR BAG PRESSURE LEDs: Green, normal operation; flashing red, alarm; flashing amber, sensor failure; steady amber, sensor bypassed.

ALARM amber SENSOR LED indicates sensor failure, red SYSTEM LED indicates system failure.

CIN green ACTIVE LED and red UNCONFIGURED LED indicate Car Internal Network (CIN) port status.

SYSTEM POWER, READY, and FAILURE LEDs indicate system status.

LOCAL ALARM ACKNOWLEDGMENT LED indicates if system is in degraded mode of operation (any sensor bypassed).

NOTE:

To bypass a defective sensor, press simultaneously on the ITSU SELF TEST and LAMP TEST buttons.
In case of multiple sensor failures, one activation of the degraded mode bypasses each defective sensor.
To cut out the ITSU, use the sealed CUTOUT switch. If the ITSU sealed CUTOUT switch fails, use the ONBOARD TL switch (cab rear wall switch panel) to recover train operation.

Figure 2-8
Integrated Truck Surveillance Unit

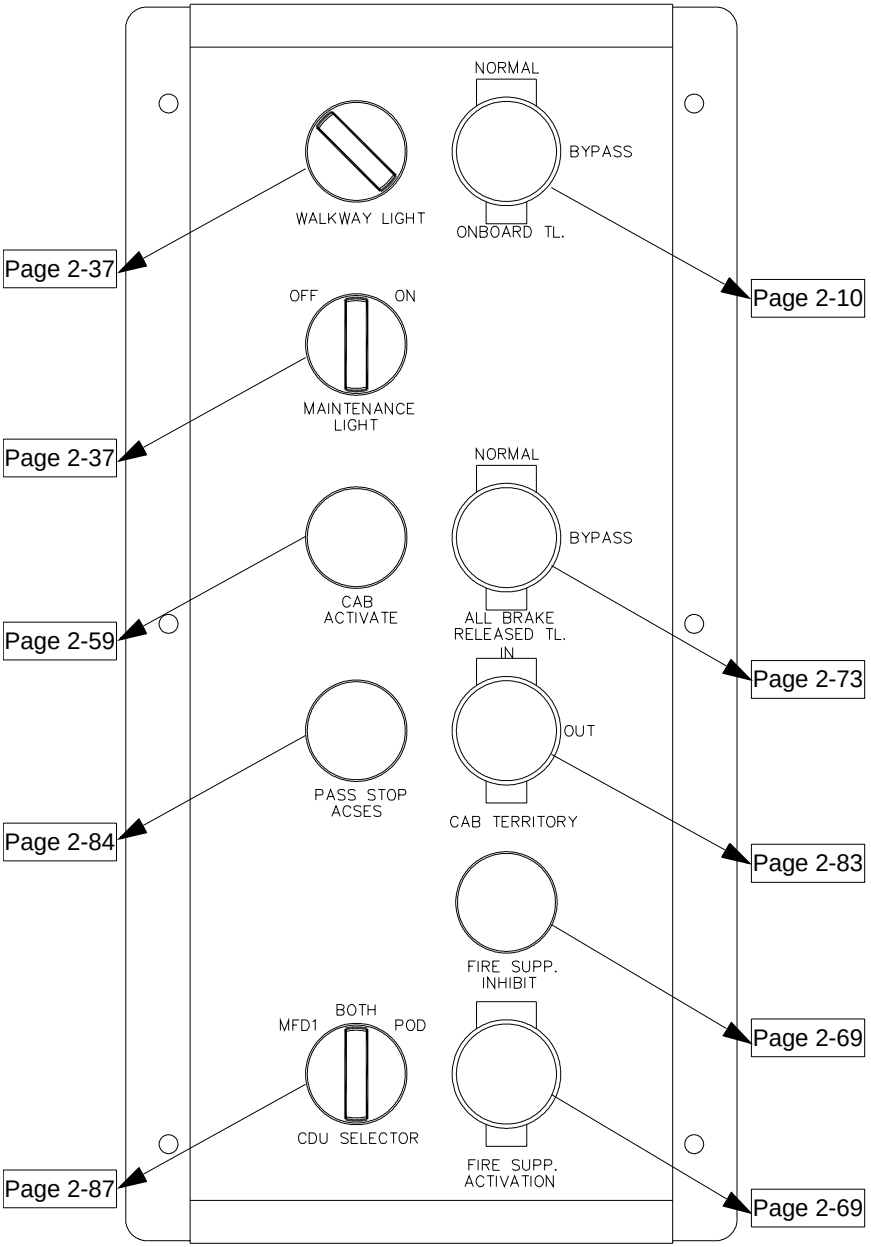


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Figure 2-9
Cab Rear Wall Switch Panel

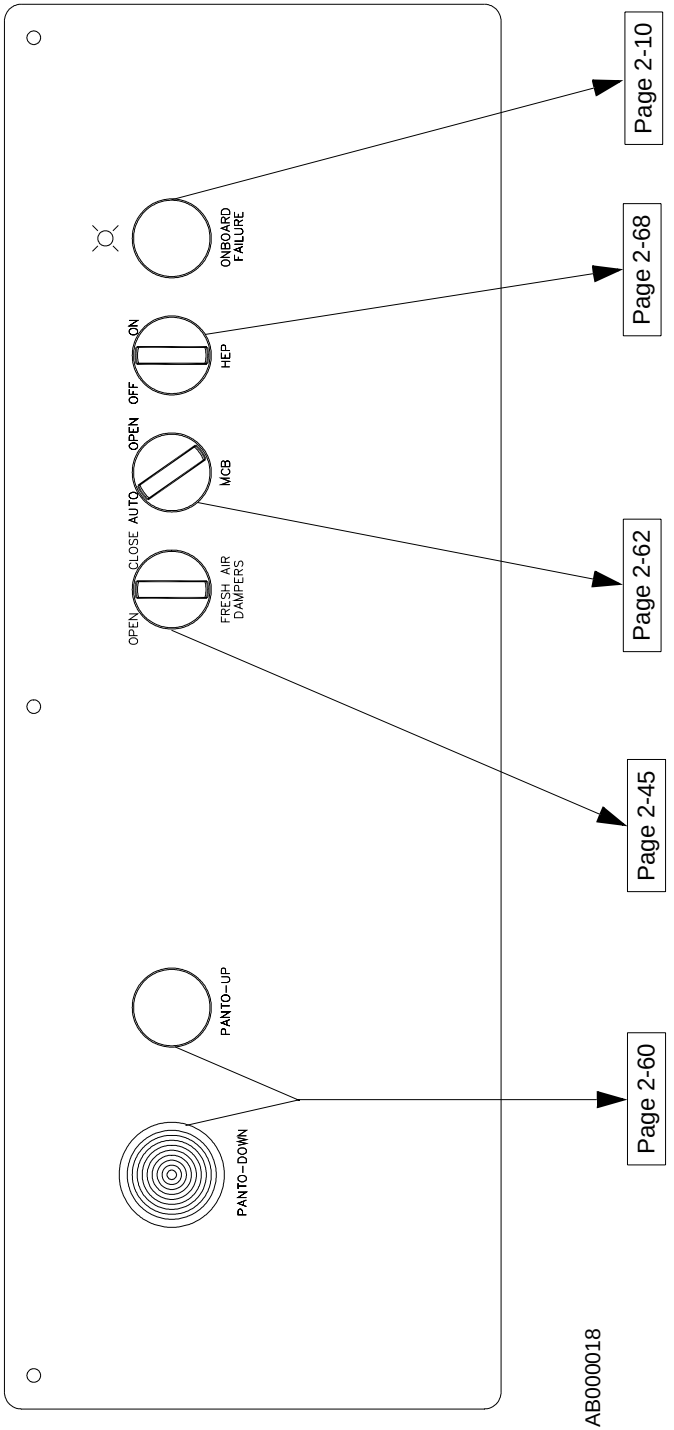

Figure 2-10
Engineer's Overhead Switch Panel

2.1.2.3.1 TILTING Switch (Fig. 2-11). The TILTING Switch, on the engineer's left switch panel, allow the engineer to enable or disable the tilting system for the whole trainset. Once the tilting is disabled, the switch has to be pushed in the ENABLE position to rearm it.

2.1.2.3.2 Tilting Master Controller (Fig. 2-12). The tilting master controller HEALTH LEDs located at the top of each card of the unit indicate the card status: if the LED is ON, the card is in good working order.

The BYPASSED LED at the bottom of the card indicates if this card is in fault and has been bypassed.

The DATA RIGHT and DATA LEFT LEDs indicate if the data from the previous and next car for each side is treated by the card.

2.1.2.3.3 Tilting Car Controller (Fig. 2-13). The tilting car controller HEALTH LEDs located at the top of each card of the unit indicate the card status: if the LED is ON, the card is in good working order.

The BYPASSED LED at the bottom of the card indicates if this card is in fault and has been bypassed.

The DATA RIGHT and DATA LEFT LEDs indicate if the data from the previous and next car for each side is treated by the card.

2.1.2.3.4 Centering Detection Cutoff Switch (Fig. 2-15). The centering detection cutoff switch, located inside the electrical locker of all passenger cars, allows the train crew to cut off the car centering detection system in case of malfunction. Refer to Subsection 2.2.7.7, on page 2-148, "Car Not Centered Alarm (Fig. 2-96)" for the procedures associated with the operation of the switch.

2.1.3 COUPLER (Fig. 2-16). The only controls and indicators available on the power car coupler are the removable uncoupling mechanism (cutting lever), and the shear indicators shown on Figure 2-16 "Power Car Coupler Main Components."

The proper operation of the coupler is verified with the telltale recess shown on Figure 2-95 "Properly Locked Coupler and Mechanical Head Exploded View." Refer to Subsection 2.2.6, on page 2-143, "Coupling (Fig. 2-94 and 2-95)", and/or to Subsection 2.2.10.7, on page 2-169, "Uncoupling (Fig. 2-94 and 2-95)" for detailed coupler operation.

The coupler is attached to the power car structure by a bolted anchor. A shear release system is incorporated into the anchor. In the event of an overspeed coupling, the buffer bottoms out and the force in the coupler assembly increases. If the buff force is too high, the cartridge is deformed by the mandrel and bracket, allowing the coupler assembly to move inboard through the anchor opening. The two red shear indication screws are then sheared off to indicate the deformation.

CAUTION:

The power car leading the trainset must coast into any other mating vehicle during coupling maneuver. Couple at speed of 2.5 mph ± 1 mph. The speed limit and coast restrictions must be adhered to in order to prevent damage to the equipment.

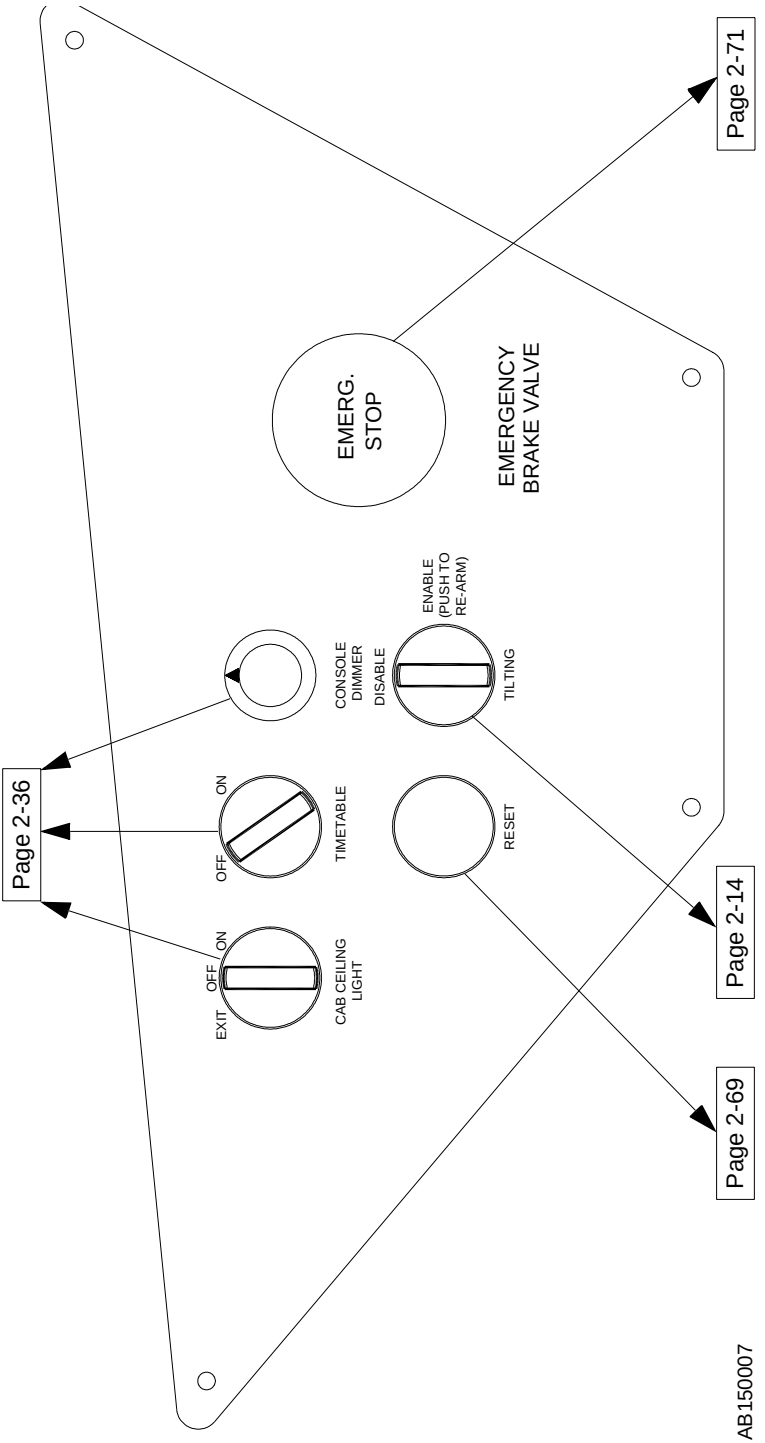

Figure 2-11
Engineer's Left Switch Panel

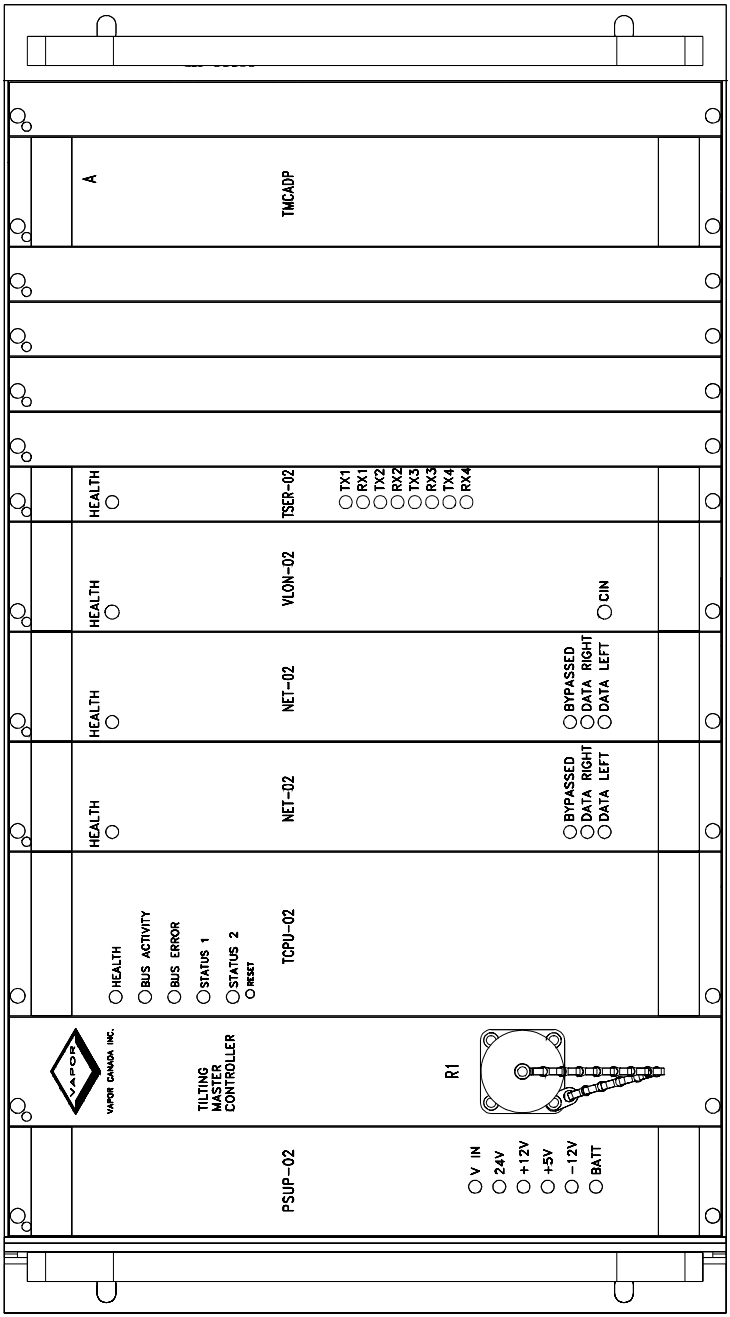

Figure 2-12
Tilting Master Controller - Power Car

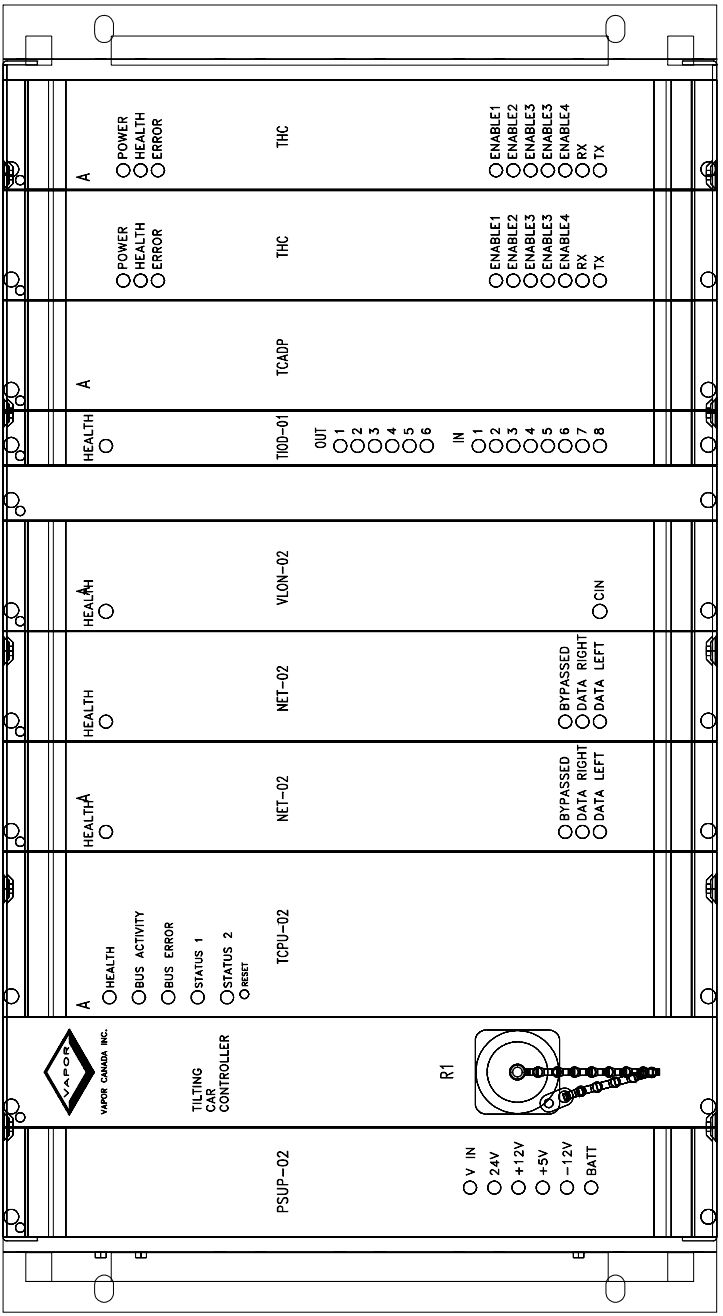

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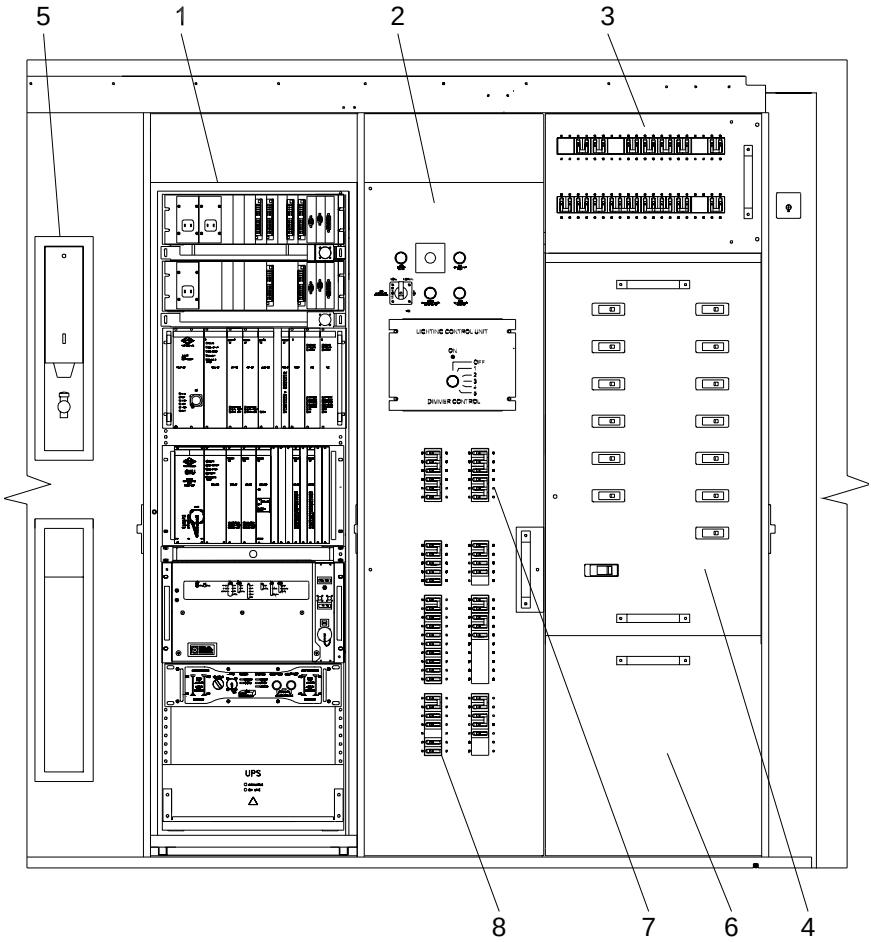
Figure 2-13
Passenger Car Tilting Car Controller - Typical



1. Computer Controlled Equipment
2. Control Equipment
3. 120 Vac Circuit Breaker Panel
4. 480 Vac Circuit Breaker Panel
5. Water Fountain
6. Access Panel
7. 28 Vdc Circuit Breaker Panel
8. 72 Vdc Circuit Breaker Panel

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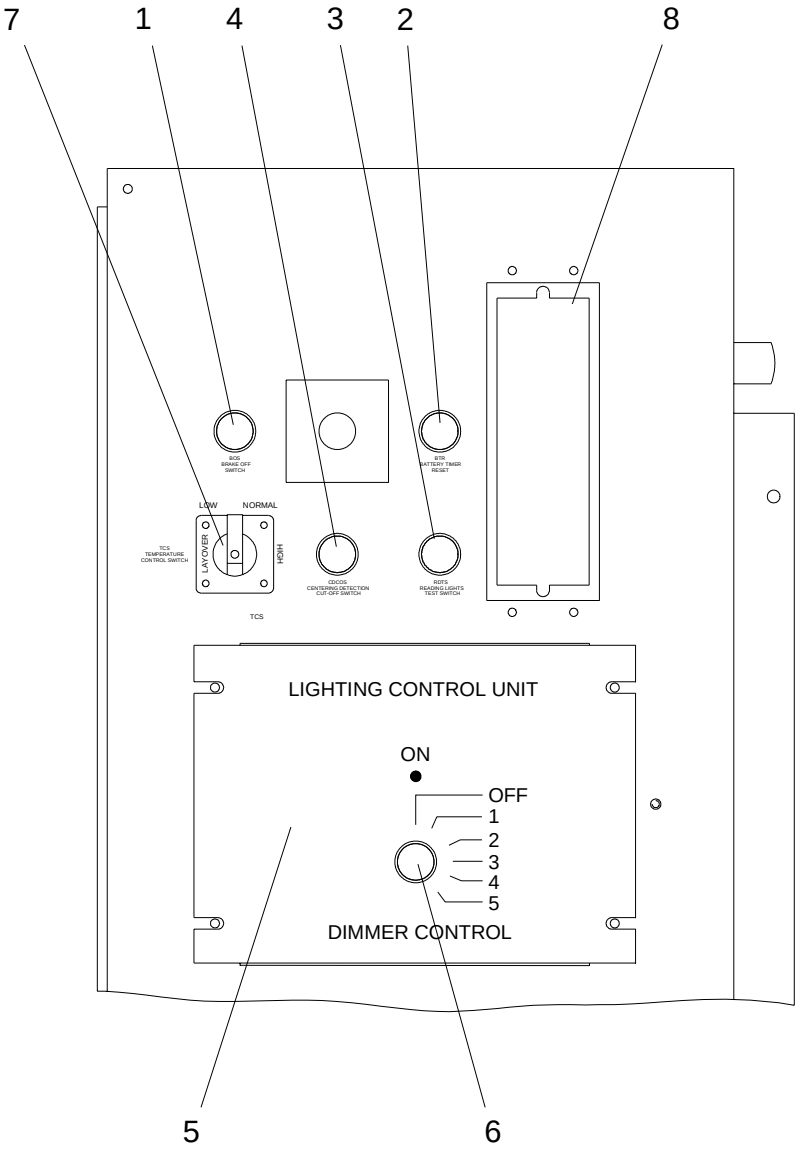
Figure 2-14
Passenger Car Electrical Locker Equipment Arrangement - Typical



1. Brake OFF Switch
2. Battery Timer Reset Switch
3. Reading Light Test Switch
4. Centering Detection Cutoff Switch
5. Lighting Control Unit
6. Lighting Dimmer Control
7. Temperature Control Switch
8. Waste Tank Status Panel

Figure 2-15
Passenger Car Electrical Locker Control Equipment - Typical

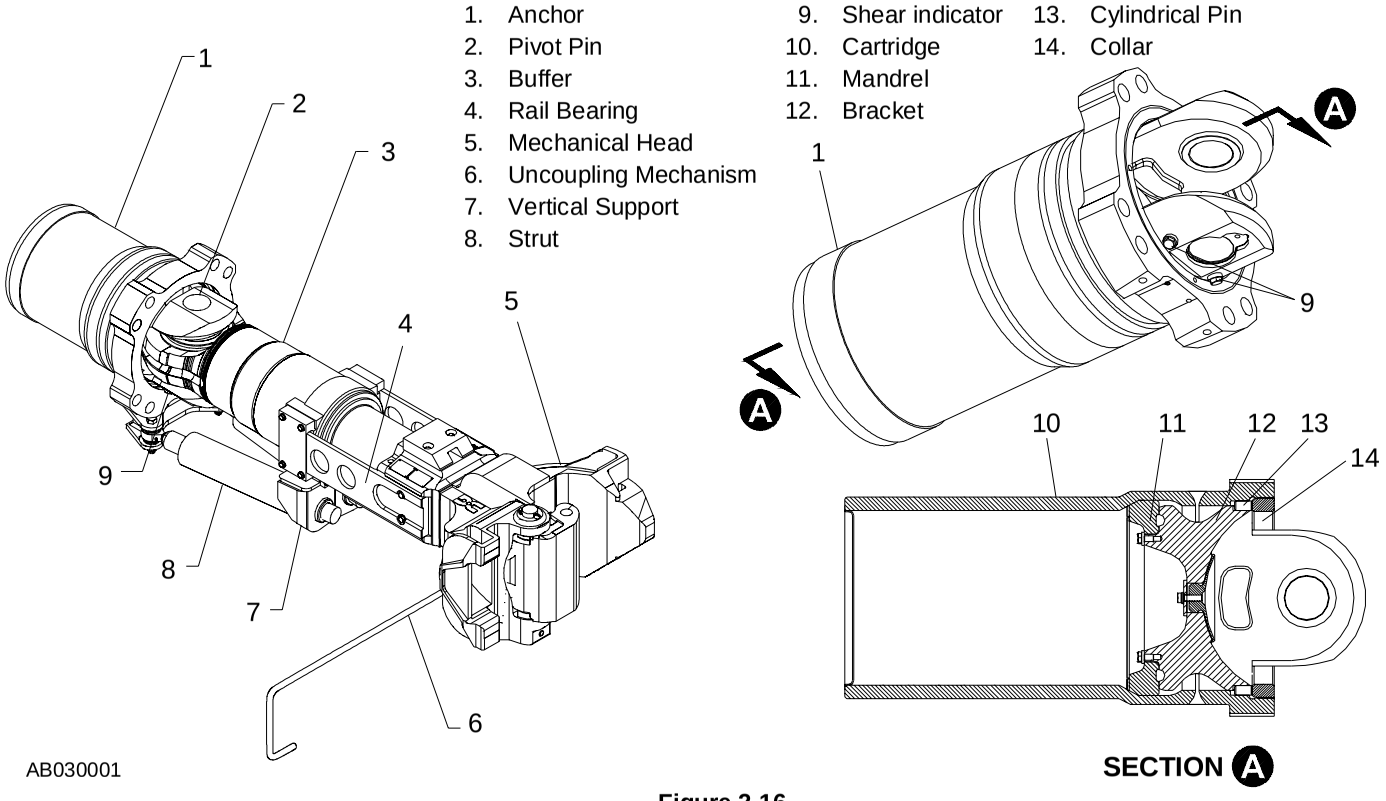


Figure 2-16
Power Car Coupler Main Components

2.1.4 ELECTRICAL DISTRIBUTION SYSTEM (Fig. 2-17 to 2-22). The following subsections list all circuit breakers that protect various systems and system functions on the trainset. The fourth column indicates in which car the circuit breaker is found (PC, power car; CO, coach car; EC, end coach car; CA, cafe car; FC, first class car). When no car type is indicated, the circuit breaker is found in all passengers cars.

2.1.4.1 480 Vac Circuit Breakers (Fig. 2-17 and 2-18).

2.1.4.1.1 Truck and Suspension Circuit Breakers.

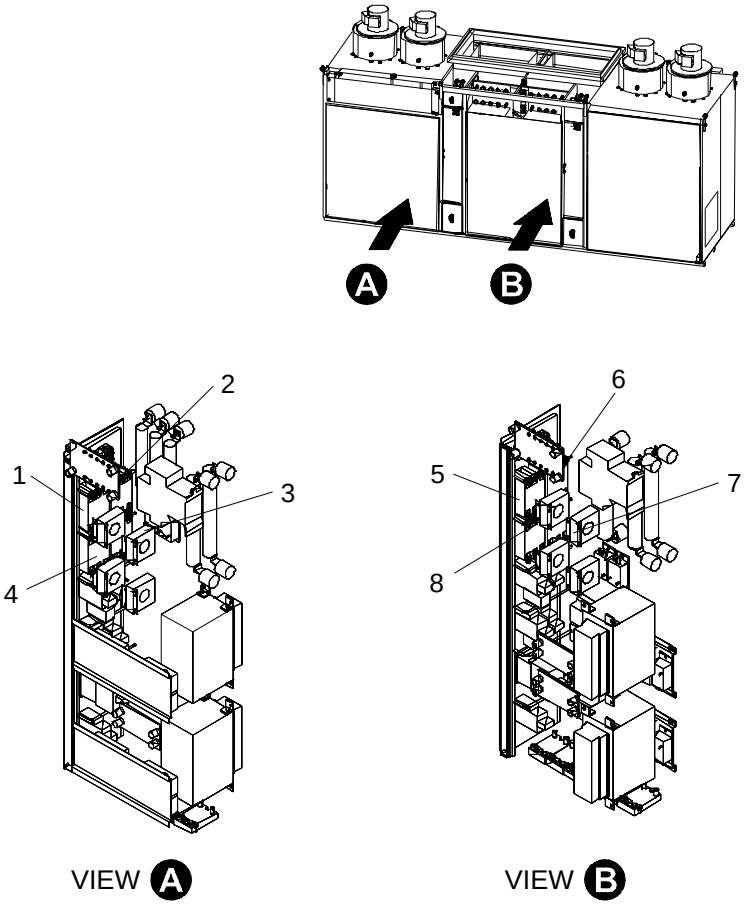
CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB7	Tilting Oil Pump	Electrical Locker	
CB6	Tilting Oil Heater	Electrical Locker	
CB13	Tilting Cooling Fan	Electrical Locker	

2.1.4.1.2 Electrical Distribution System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB33	480V/120V Transformer	Auxiliary Block	PC
CB31	Battery Charger No. 1	Auxiliary Block	PC
CB32	Battery Charger No. 2	Auxiliary Block	PC
CB1	480V Main 1	Electrical Locker	
CB1A	480V Main 2	Electrical Locker	IN
CB2	Battery Charger	Electrical Locker	
CB3	LVPS	Electrical Locker	
CB4	120V Xformer Primary	Electrical Locker	
CB5	208V Xformer Primary	Electrical Locker	EC, CA, FC

2.1.4.1.3 HVAC Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB21	HVAC Unit	Auxiliary Block	PC
CB23	Toilet and Cab Heaters	Auxiliary Block	PC
CB25	Windshield Heater and Defogger	Auxiliary Block	PC
CB8	HVAC Unit - A	Electrical Locker	
CB9	HVAC Unit - B	Electrical Locker	
CB10	Floor Heat 1	Electrical Locker	
CB11	Floor Heat 2	Electrical Locker	
CB12	Vestibule Heat -A	Electrical Locker	
CB15	Vestibule Heat -B	Electrical Locker	



1. CB1, Rheostatic and Main Transformer Blower No. 1 (CB-MF-MT-1)
2. CB11, Motor Block Water Pump No. 2 (CB-M-WP-2)
3. CB3, Motor Block Blower No. 1 (CB-MF-PCS-1)
4. CB4, Motor Block Blower No. 2 (CB-MF-PCS-2)
5. CB2, Rheostatic and Main Transformer Blower No. 2 (CB-MF-MT-2)
6. CB10, Motor Block Water Pump No. 1 (CB-M-WP-1)
7. CB5, Motor Block Blower No. 3 (CB-MF-PCS-3)
8. CB6, Motor Block Blower No. 4 (CB-MF-PCS-4)

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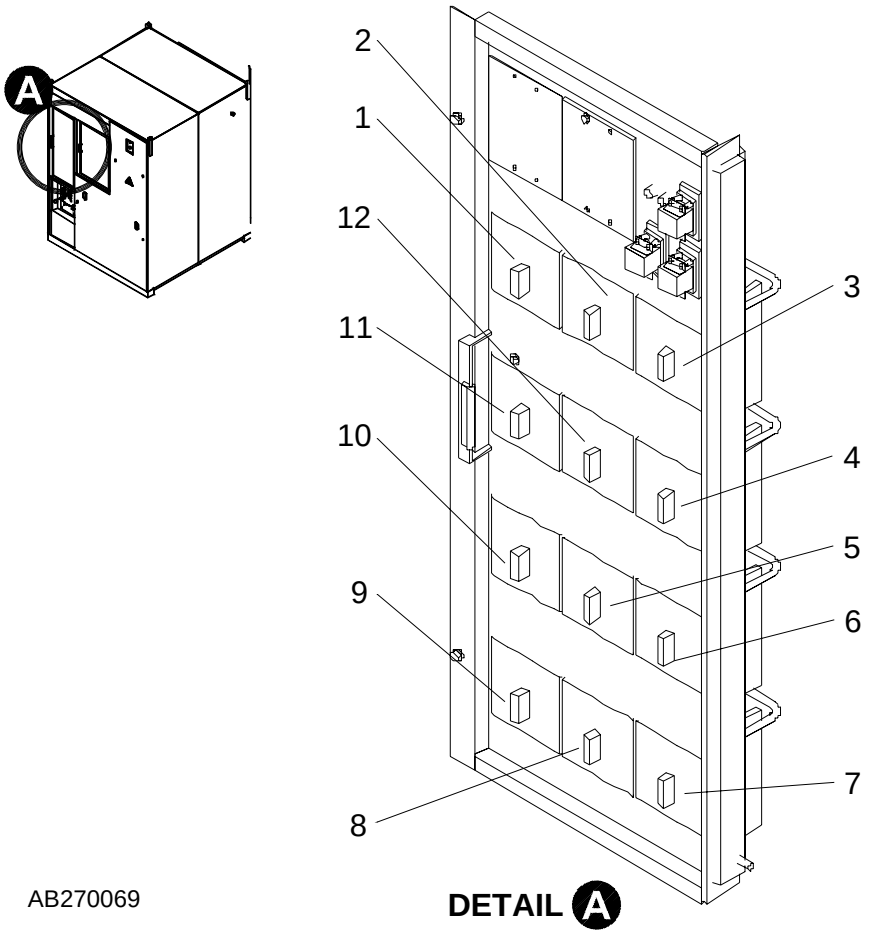
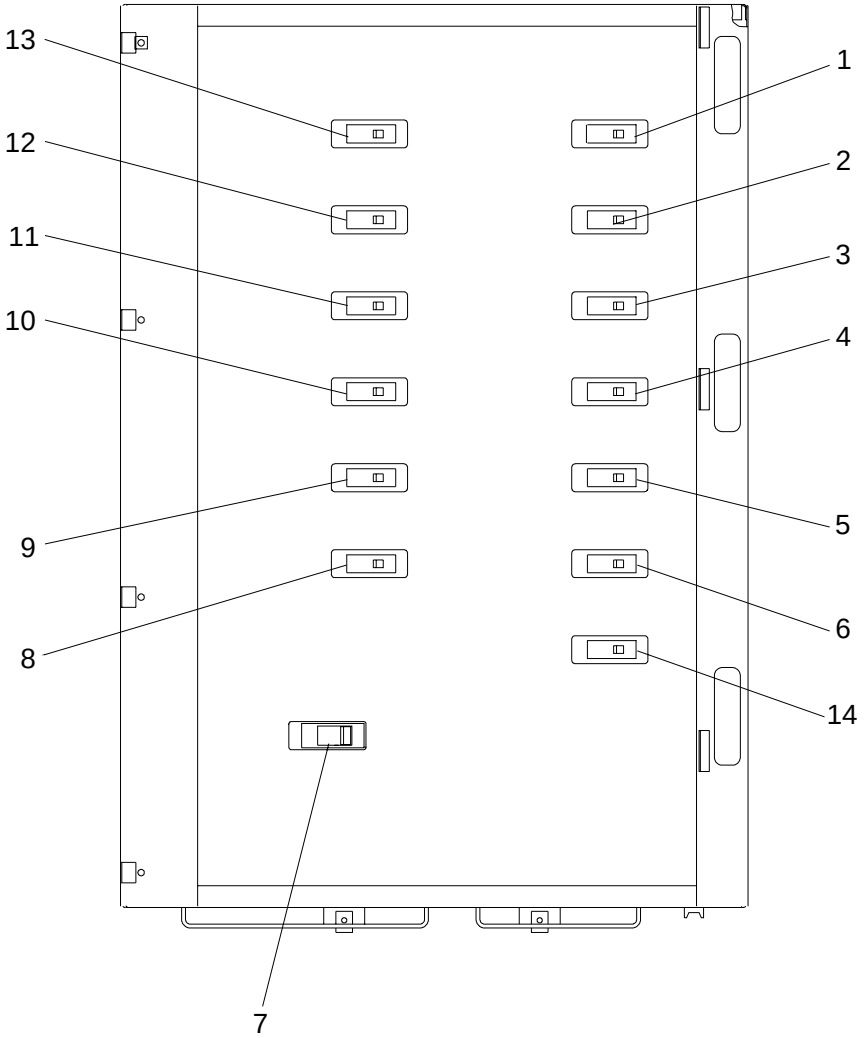
Figure 2-17
Central Block Circuit Breakers



1. CB25, Windshield Heater and Defogger (CB-HUE-F)
2. CB23, Toilet and Cab Heaters (CB-TH-CH-F)
3. CB30, Master Air Compressor (CB-M-CP)
4. CB21, HVAC Unit (CB-HVAC-F)
5. CB8, Traction Motor No. 1 and No. 2 Blowers (CB-MF-MTT-1)
6. CB9, Traction Motor No. 3 and No. 4 Blowers (CB-MF-MTT-2)
7. CB34, Lower Drain Heater (Provision for Future use) (CB-HUE-1)
8. CB14, Main Transformer Oil Pump No. 2 (CB-M-OP-2)
9. CB13, Main Transformer Oil Pump No. 1 (CB-M-OP-1)
10. CB33, 480/120 Vac Transformer (CB-TB-120)
11. CB31, Battery Charger No. 1 (CB-BA-CH-1)
12. CB32, Battery Charger No. 2 (CB-BA-CH-2)

Figure 2-18
Auxiliary Block Circuit Breaker Panel



1. CB8 - HVAC Unit A
2. CB9 - HVAC Unit B
3. CB10 - Floor Heat 1
4. CB11 - Floor Heat 2
5. CB12 - Vestibule Heat A
6. CB15 - Vestibule Heat B
7. CB1 - 480V Main 1
8. CB13 - Tilting Cooling Fan
9. CB7 - Tilting Oil Pump
10. CB6 - Tilting Oil Heater
11. CB4 - 120 V XFMR Primary
12. CB3 - LVPS
13. CB2 - Battery Charger
14. CB5 - 208 V XFMR Primary

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Figure 2-19
Passenger Cars 480 Vac Circuit Breaker Panel - Typical

2.1.4.1.4 Propulsion and Electric Braking Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB1	Rheostatic and Main Transformer Blower No. 1	Central Block	PC
CB2	Rheostatic and Main Transformer Blower No. 2	Central Block	PC
CB3	Motor Block Blower No. 1	Central Block	PC
CB4	Motor Block Blower No. 2	Central Block	PC
CB5	Motor Block Blower No. 3	Central Block	PC
CB6	Motor Block Blower No. 4	Central Block	PC
CB10	Motor Block Water Pump No. 1	Central Block	PC
CB11	Motor Block Water Pump No. 2	Central Block	PC
CB8	Traction Motors No. 1 and No. 2 Blower	Auxiliary Block	PC
CB9	Traction Motors No. 3 and No. 4 Blower	Auxiliary Block	PC
CB13	Main Transformer Oil Pump No. 1	Auxiliary Block	PC
CB14	Main Transformer Oil Pump No. 2	Auxiliary Block	PC

2.1.4.1.5 Friction Brake Equipment Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB30	Main Air Compressor	Auxiliary Block	PC

2.1.4.2 120 Vac Circuit Breakers (Fig. 2-20 and 2-21).

2.1.4.2.1 Carbody, Interior Fixtures, Operating Cab Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB35	Telephone System	Electrical Locker	

2.1.4.2.2 Electrical Distribution System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB46	120 Vac Receptacles	Electrical Locker No. 3	PC
CB42	120 Vac Refrigerator Receptacles	Electrical Locker No. 3	PC
CB30	12V Xformer Primary	Electrical Locker	CO, EC, FC
CB40	UPS AC Feed	Electrical Locker	
CB41	120 V Conv. Recept.-Left	Electrical Locker	
CB42	120 V Conv. Recept.-Right	Electrical Locker	

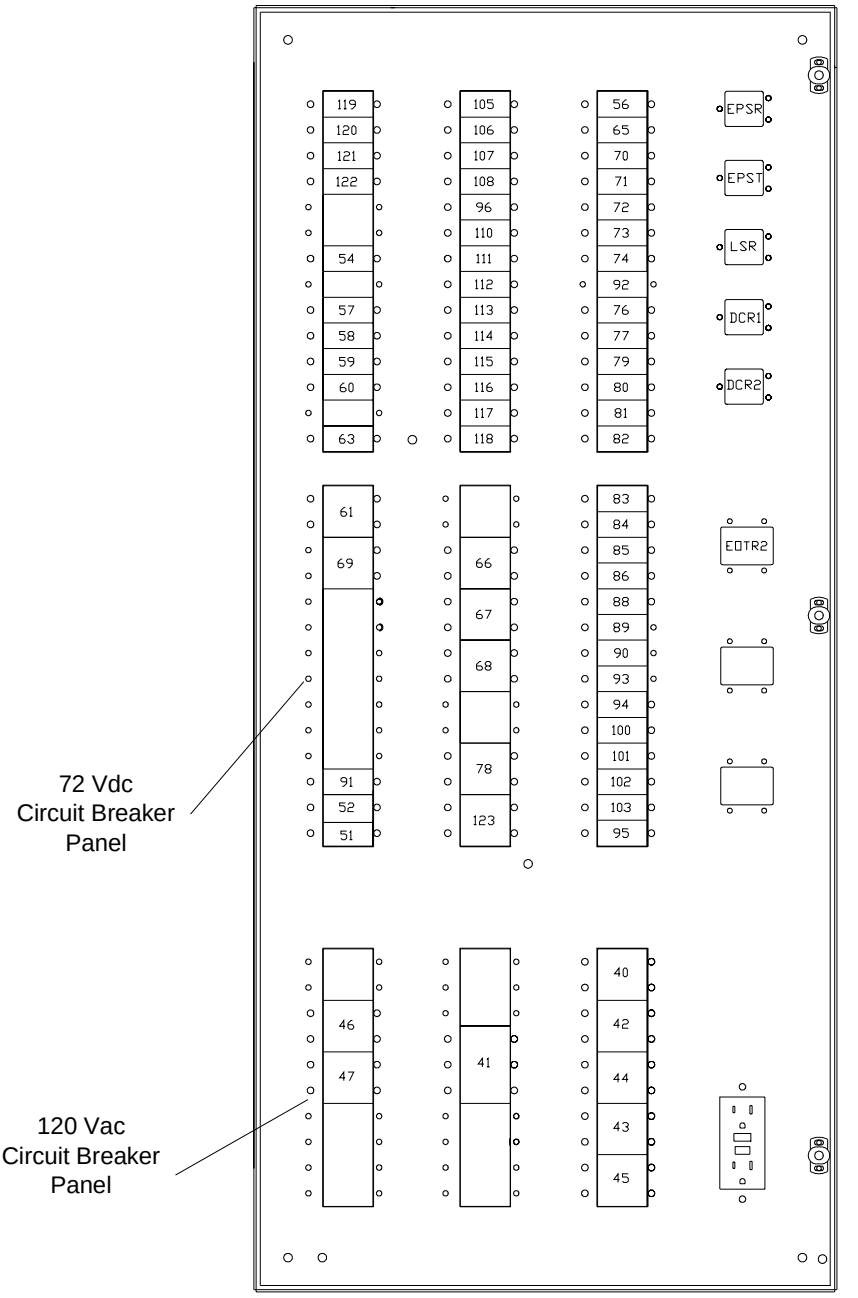

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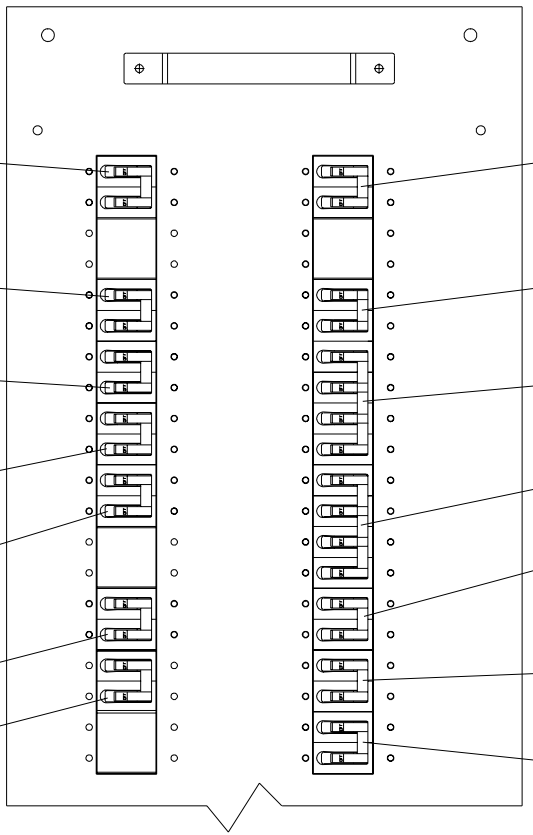
Figure 2-20
Power Car 72 Vdc and 120 Vac Circuit Breaker Panels
(Electrical Locker No. 3)

Legend for Figure 2-20
120VAC CIRCUIT BREAKER PANEL

CB NO.	SYSTEM	CB NO.	SYSTEM
CB40	HVAC Control	CB44	Workstation/Point of Sale
CB41	Freeze Protection	CB46	120 Vac Receptacle
CB42	120 Vac Refrigerator Receptacles	CB47	Maintenance Lighting
CB43	Entertainment 120V Inverter		

72VDC CIRCUIT BREAKER PANEL

CB NO.	SYSTEM	CB NO.	SYSTEM
CB51	Control Rear Panto& Aux Air Compressor	CB86	Printers & Wipers
CB52	Access Lighting	CB88	Tilting Master Controller
CB54	Cab Controls	CB89	Tilting Master Sensor No. 1
CB56	General Controls	CB90	Tilting Master Sensor No. 2
CB57	Cab Lighting	CB91	Snow/Parking/Sanding Brake
CB58	Walkway Lights	CB92	All Brakes Released
CB59	Markers Lights	CB93	Onboard Detection T/L
CB60	Headlights	CB94	Door Closed & Locked T/L
CB61	Alerter/Recorder	CB96	No Motion T/L
CB63	Communication Control/Radio	CB100	AGATE Control 1
CB65	Temperature Controllers	CB101	AGATE Control 2
CB66	ATC	CB102	AGATE Control 3
CB67	ACSES	CB103	AGATE Control 4
CB68	ADU	CB105	Power Supply Gate Drive System 1
CB69	Speed Sensing	CB106	Power Supply Gate Drive System 2
CB70	WSCC/IFM	CB107	Power Supply Gate Drive System 3
CB71	BCC/DNRA	CB108	Power Supply Gate Drive System 4
CB72	Pneumatic Brakes	CB111	RIOM 2
CB73	Air Supply Unit Controller	CB112	RIOM 3
CB74	EP Assist	CB113	RIOM 4
CB76	Ditch Lights	CB114	RIOM 5
CB77	Integrated Truck Surveillance	CB115	RIOM 6
CB78	EMI Limit Detection	CB116	MPU 1
CB79	Toilet Control	CB117	MPU 2
CB80	Car Monitoring Unit	CB118	I/O MPU 1
CB81	Monitoring Input/Output	CB119	I/O MPU 2
CB82	CIN Router	CB120	Fire Suppression System
CB83	Primary Operating Displays	CB121	Control Tap Changer
CB84	Multifunction Displays No. 1	CB122	Control Pantograph Front
CB85	Multifunction Displays No. 2	CB123	HEP Control and Contactors



1. CB35, Telephone System
2. CB31, HVAC Control - A
3. CB32, HVAC Control - B
4. CB48, Fans and Heaters Control
5. CB37, Water Cooler
6. CB46, Toilet Control 120V
7. CB38, ADA Toilet Hand Dryer
8. CB36, Hot Water Tanks
9. CB34, Freeze Protection
10. CB34, Freeze Protection
11. CB42, 120 V Conv. Recept.- Right
12. CB41, 120 V Conv. Recept.- Left
13. CB40, UPS AC Feed
14. CB35, Telephone System

NOTE:
Circuit Breaker CB39, Conventional Toilet Hand Dryer (coach car only), is not shown.

Figure 2-21
Passenger Car 120 Vac Circuit Breaker Panel - Typical

2.1.4.2.3 Lighting and Indicators Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB47	Maintenance Lighting	Electrical Locker No. 3	PC

2.1.4.2.4 HVAC Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB40	HVAC Control	Electrical Locker No. 3	PC
CB41	Freeze Protection	Electrical Locker No. 3	PC
CB44	Windshield Heater and Defogger Control	Electrical Locker No. 3	PC
CB45	Foot Platform	Electrical Locker No. 3	PC
CB31	HVAC Control - A	Electrical Locker	
CB32	HVAC Control - B	Electrical Locker	
CB34	Freeze Protection	Electrical Locker	
CB48	Fans and Heaters Control	Electrical Locker	

2.1.4.2.5 Water and Waste Retention System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB43	Waste Collection and Retention	Electrical Locker No. 3	PC
CB36	Hot Water Tanks	Electrical Locker	
CB37	Water Cooler	Electrical Locker	
CB38	ADA Toilet Hand Dryer	Electrical Locker	
CB39	Unisex Toilet Hand Dryer	Electrical Locker	CO
CB46	Toilet Control 120V	Electrical Locker	

2.1.4.3 72 Vdc Circuit Breakers (Fig. 2-20 and 2-22).

2.1.4.3.1 Carbody, Interior Fixtures, Operating Cab Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB43	Entertainment 120 V Inverter	Electrical Locker	CA
CB44	Workstation/Point of Sale	Electrical Locker	CA
CB56	General Controls	Electrical Locker No. 3	PC
CB61	Alerter/Recorder	Electrical Locker No. 3	PC
CB93	Onboard Detection T/L	Electrical Locker No. 3	PC
CB94	Door Closed & Locked T/L	Electrical Locker No. 3	PC
CB96	PCU Power Supply	Electrical Locker	

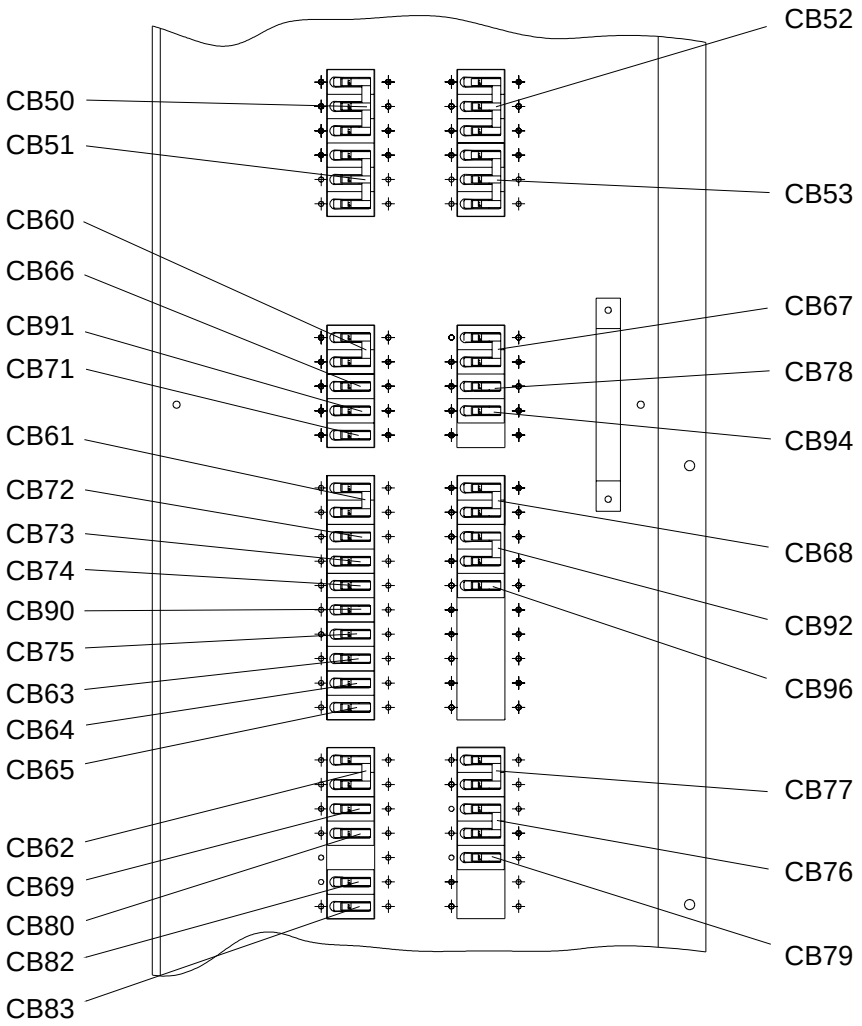


Figure 2-22
Passenger Car 28 Vdc and 72 Vdc Circuit Breaker Panels - Typical

Legend for Figure 2-22

72VDC CIRCUIT BREAKER PANEL

CB NO.	SYSTEM	CB NO.	SYSTEM
CB43	Entertainment 120 V Inverter (CA Only)	CB77	Emergency & Service Lights - A
CB44	Workstation/Point of Sale (CA Only)	CB78	Display Sign Lights
CB60	Main DC Stage 1 Min	CB79	Communication System
CB61	Main DC Stage I	CB80	Side Door Controls - A
CB62	Main DC Stage II	CB81	Side Door Controls - B (CO, CA Only)
CB63	Tilting Car Controller	CB82	Interior Door Controls - B
CB64	Tilting Hydraulic Controller 1	CB83	Toilet Controls
CB65	Tilting Hydraulic Controller 2	CB85	Data Management System (CA Only)
CB66	HVAC Control - A	CB86	RAM Data Radio (CA Only)
CB67	Mirror & Advertisement Lights	CB87	CDPD Data Radio (CA Only)
CB68	Indirect & Aisle Lights Right (CO, EC, FC Only)	CB88	Multifunction Display (CA Only)
CB68	Indirect & Aisle Lights (CA Only)	CB89	Printer (CA Only)
CB69	Door Closed & Locked Circuitry	CB90	CMU Discrete Inputs
CB71	120 V UPS DC Feed	CB91	HVAC Control - B
CB72	Wheel Slip Control Computer	CB92	Indirect & Aisle Lights Left (CO, EC, FC Only)
CB73	Detection of Nonrotating Axle	CB94	ADA Toilet Door Lock
CB74	Car Monitoring Unit	CB95	Unisex Toilet Door Lock (CO Only)
CB75	Integrated Truck Surveillance System	CB96	PCU Power Supply
CB76	Emergency & Service Lights - B		

28VDC CIRCUIT BREAKER PANEL

CB NO.	SYSTEM	CB NO.	SYSTEM
CB50	Reading Lights - A Left	CB53	Reading Lights - B Right (CO, EC, FC Only)
CB51	Reading Lights - A Right (CO, EC, FC Only)	CB55	Food Service Equipment (EC, CA, FC Only)
CB52	Reading Lights - B Left		

2.1.4.3.2 Truck and Suspension Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB77	Integrated Truck Surveillance	Electrical Locker No. 3	PC
CB88	Tilting Master Controller	Electrical Locker No. 3	PC
CB89	Tilting Master Sensor No. 1	Electrical Locker No. 3	PC
CB90	Tilting Master Sensor No. 2	Electrical Locker No. 3	PC
CB63	Tilting Car Controller	Electrical Locker	
CB64	Tilting Hydraulic Controller 1	Electrical Locker	
CB65	Tilting Hydraulic Controller 2	Electrical Locker	
CB75	Integrated Truck Surveillance System	Electrical Locker	

2.1.4.3.3 Electrical Distribution System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB50	72 Vdc Battery Main Breaker	Rear Wall	PC
CB60	Main DC Stage 1 Min	Electrical Locker	
CB61	Main DC Stage I	Electrical Locker	
CB62	Main DC Stage II	Electrical Locker	
CB71	120 V UPS DC Feed	Electrical Locker	

2.1.4.3.4 Lighting and Indicators Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB52	Access Lighting	Electrical Locker No. 3	PC
CB57	Cab Lighting	Electrical Locker No. 3	PC
CB58	Walkway Lights	Electrical Locker No. 3	PC
CB59	Marker Lights	Electrical Locker No. 3	PC
CB60	Headlights	Electrical Locker No. 3	PC
CB76	Ditch Light	Electrical Locker No. 3	PC
CB67	Mirror & Advertisement Lights	Electrical Locker	
CB68	Indirect & Aisle Lights Right	Electrical Locker	CO, EC, FC
CB68	Indirect & Aisle Lights	Electrical Locker	CA
CB76	Emergency & Service Lights - B	Electrical Locker	
CB77	Emergency & Service Lights - A	Electrical Locker	
CB78	Display Sign Lights	Electrical Locker	
CB92	Indirect & Aisle Lights Left	Electrical Locker	CO, EC, FC

2.1.4.3.5 Door Control and Signal System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB96	No Motion T/L	Electrical Locker No. 3	PC
CB69	Door Closed & Locked Circuitry	Electrical Locker	
CB80	Side Door Controls - A	Electrical Locker	
CB81	Side Door Controls - B	Electrical Locker	CO, CA
CB82	Interior Door Controls - B	Electrical Locker	

2.1.4.3.6 HVAC Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB65	Temperature Controllers	Electrical Locker No. 3	PC
CB66	HVAC Control - A	Electrical Locker	
CB91	HVAC Control - B	Electrical Locker	

2.1.4.3.7 Communication Systems Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB63	Communication Control/Radio		PC
CB79	Communication System	Electrical Locker	

2.1.4.3.8 Propulsion and Electric Braking Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB51	Control Rear Panto & Aux Air Compressor	Electrical Locker No. 3	PC
CB54	Cab Controls	Electrical Locker No. 3	PC
CB78	EMI Limit Detection	Electrical Locker No. 3	PC
CB100	AGATE Control 1	Electrical Locker No. 3	PC
CB101	AGATE Control 2	Electrical Locker No. 3	PC
CB102	AGATE Control 3	Electrical Locker No. 3	PC
CB103	AGATE Control 4	Electrical Locker No. 3	PC
CB105	Power Supply Gate Drive System 1	Electrical Locker No. 3	PC
CB106	Power Supply Gate Drive System 2	Electrical Locker No. 3	PC
CB107	Power Supply Gate Drive System 3	Electrical Locker No. 3	PC
CB108	Power Supply Gate Drive System 4	Electrical Locker No. 3	PC
CB110	RIOM 1	Central Block	PC
CB111	RIOM 2	Electrical Locker No. 3	PC
CB112	RIOM 3	Electrical Locker No. 3	PC

Propulsion and Electric Braking Circuit Breakers (Cont'd).

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB113	RIOM 4	Electrical Locker No. 3	PC
CB114	RIOM 5	Electrical Locker No. 3	PC
CB115	RIOM 6	Electrical Locker No. 3	PC
CB116	MPU1	Electrical Locker No. 3	PC
CB117	MPU2	Electrical Locker No. 3	PC
CB118	I / O MPU1	Electrical Locker No. 3	PC
CB119	I / O MPU2	Electrical Locker No. 3	PC
CB120	Fire Suppression System	Electrical Locker No. 3	PC
CB121	Control Tap Changer	Electrical Locker No. 3	PC
CB122	Control Pantograph Front	Electrical Locker No. 3	PC
CB123	HEP Control and Contactors	Electrical Locker No. 3	PC

2.1.4.3.9 Friction Brake Equipment Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB70	WSCC / IFM	Electrical Locker No. 3	PC
CB71	BCC / DNRA	Electrical Locker No. 3	PC
CB72	Pneumatic Brakes	Electrical Locker No. 3	PC
CB73	Air Supply Unit Controller	Electrical Locker No. 3	PC
CB74	EP Assist	Electrical Locker No. 3	PC
CB91	Snow/Parking/Sanding Brake	Electrical Locker No. 3	PC
CB92	All Brakes Released	Electrical Locker No. 3	PC
CB72	Wheel Slip Control Computer	Electrical Locker	
CB73	Detection of Nonrotating Axle	Electrical Locker	

2.1.4.3.10 Cab Signal and Automatic Train Control Systems Circuit Breakers - Safety Related Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB66	ATC	Electrical Locker No. 3	PC
CB67	ACSES	Electrical Locker No. 3	PC
CB68	ADU	Electrical Locker No. 3	PC
CB69	Speed Sensing	Electrical Locker No. 3	PC

2.1.4.3.11 Train Monitoring and Data Management Systems Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB80	Car Monitoring Unit	Electrical Locker No. 3	PC
CB81	Monitoring Input / Output	Electrical Locker No. 3	PC
CB82	CIN Router	Electrical Locker No. 3	PC
CB83	Primary Operating Displays	Electrical Locker No. 3	PC
CB84	Multifunction Displays No. 1	Electrical Locker No. 3	PC
CB85	Multifunction Displays No. 2	Electrical Locker No. 3	PC
CB86	Printers	Electrical Locker No. 3	PC
CB74	Car Monitoring Unit	Electrical Locker	
CB85	Data Management System	Electrical Locker	CA
CB86	RAM Data Radio	Electrical Locker	CA
CB87	CDPD Data Radio	Electrical Locker	CA
CB88	Multifunction Display	Electrical Locker	CA
CB89	Printer	Electrical Locker	CA
CB90	CMU Discrete Inputs	Electrical Locker	

2.1.4.3.12 Water and Waste Retention System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB79	Toilet Control	Electrical Locker No. 3	PC
CB83	Toilet Controls	Electrical Locker	
CB94	ADA Toilet Door Lock	Electrical Locker	
CB95	Unisex Toilet Door Lock	Electrical Locker	CO

2.1.4.4 28Vdc Circuit Breakers.

2.1.4.4.1 Electrical Distribution System Circuit Breakers.

CIRCUIT BREAKER	FEEDS AND PROTECTS	LOCATION	CAR
CB50	Reading Lights - A Left	Electrical Locker	
CB51	Reading Lights - A Right	Electrical Locker	CO, EC, FC
CB52	Reading Lights - B Left	Electrical Locker	
CB53	Reading Lights - B Right	Electrical Locker	CO, EC, FC
CB55	Food Service Equipment	Electrical Locker	EC, CA, FC

2.1.5 LIGHTING AND INDICATORS. The following subsections describe the trainset exterior and interior lighting controls and indicators.

2.1.5.1 Power Car Access Lighting (Fig. 2-11). The access lighting, including exterior ground lights and all incandescent lights (near door entrances and in the cab ceiling) is controlled by the following switches:

- Exterior switches, near the ladders,
- Interior switches, near the door entrances,
- CAB CEILING LIGHT switch (engineer's left switch panel), in EXIT position.

All these switches turn on, for one minute, all the access lighting.

2.1.5.2 Headlights (Fig. 2-3). The FRONT HEADLIGHT switch, on the engineer's desk right switch panel, when activated in DIM or BRIGHT position, illuminates the power car headlights. Since the nonleading cab is not active, its respective headlights cannot be illuminated.

2.1.5.3 Ditch Lights (Fig. 2-3). The power car ditch lights are controlled by the DITCH LIGHT switch on the engineer's desk right switch panel. They operate only when the headlights are on. The Car Monitoring Unit (CMU) activates the AUTO position.The switch positions allow the following modes of operation:

- ON: Ditch lights continuously operative.
- AUTO: Ditch lights flash alternately when the horn is blown (by footswitch or hand switch). They continue to flash until the bell is silenced with the BELL button on the engineer's desk right switch panel, or until the switch is set to OFF.
- FLASH: Ditch lights flash alternately.
- OFF: Ditch lights inoperative.

NOTE:

In emergency mode (when the HEP is lost), the ditch lights are inoperative.

2.1.5.4 Marker Lights. An automatic control activates the trailing power car marker lights when the cab is activated.

2.1.5.5 Power Car Exterior Ground Lights. The exterior ground lights are turned on for a one-minute period when any of the following switches is activated:

- Exterior switches, near the ladders,
- Interior switches, near the door entrances,
- CAB CEILING LIGHT switch (engineer's left switch panel), in EXIT position.

2.1.5.6 Cab Ceiling Lights (Fig. 2-11). The CAB CEILING LIGHT switch (engineer's left switch panel) turns on the power car cab ceiling lights when in ON position. When in EXIT position, the access lights listed above turn on for one minute.

2.1.5.7 Power Car Timetable and Console Lights (Fig. 2-4 and 2-11). The TIMETABLE switches on the engineer's left switch panel and the assistant's left switch panel turn on their respective timetable light when in the ON position. The CONSOLE DIMMER switch on the engineer's left switch panel controls the intensity of the console lighting.

2.1.5.8 Cab Step Light. The cab step light is operative in all modes.

2.1.5.9 Power Car Walkway Lights (Fig. 2-9). The WALKWAY LIGHT switch on the cab rear wall switch panel turns on the walkway lights in alternate position.

2.1.5.10 Power Car Maintenance Lights (Fig. 2-9). The MAINTENANCE LIGHT switch on the cab rear wall switch panel turns on the maintenance lights and the cab ceiling lights for one hour when placed in the alternate position.

2.1.5.11 Power Car Toilet Light. A toilet timer switch, located on the toilet wall, turns on the toilet light and activates the toilet exhaust fan for ten minutes when activated.

2.1.5.12 Passenger Cars Lights. Some lights in the passenger cars are automatically operated. These are the accent lights, advertisement signs, and tool light.

The other lights in the passenger cars are controlled as follows:

- Electrical locker light: Illuminates when the locker door is open.
- Entryway light, passageway lights, small galley ceiling light: Dimmed automatically in emergency mode by the lighting controller.
- Thin passageway light, toilet ceiling light: Automatically dimmed in standby and emergency modes by the lighting controller.
- Aisle lights: Off in emergency mode. A dimmer switch is located on the lighting control unit, inside the electrical locker.
- Ceiling panel lights: A dimmer switch is located on the lighting control unit inside the electrical locker.
- Reading lights: Intensity is controlled by the reading light panel. The switch allows selection of OFF, DIM, and ON positions.

2.1.6 DOORS, DOOR CONTROL AND SIGNAL SYSTEM. The following subsections describe the controls and indicators related to the operation of all the doors in the trainset.

WARNING:

THE DOORS SLAM IF THE ENGINEER'S DOOR OPEN SWITCH IS ACTIVATED WHEN THE DOORS ARE OPENED. EXERCISE CAUTION WHEN USING THE DOOR OPEN SWITCH. FAILING TO RESPECT THIS CONDITION MAY RESULT IN INJURY.

2.1.6.1 DOOR OPEN Switch (Fig. 2-5). The DOOR OPEN switch, on the engineer's right switch panel, is used to prevent side doors opening when placed in INHIBIT position. When this momentary switch is used by the engineer, side door operation by other crew members is inhibited. The switch should normally be used when the trainset is not properly positioned at a station stop/platform.

2.1.6.2 DOORS CLOSED AND LOCKED Switch (Fig. 2-5).

A wrong "doors closed and locked" signal from a car causes a loss of traction power. This signal can be bypassed by placing the DOORS CLOSED AND LOCKED

sealed switch on the engineer's right switch panel in the BYPASS position to recover normal operation.

NOTE:

The DOORS CLOSED AND LOCKED switch is shrouded.

2.1.6.3 NO-MOTION BYPASS Switch (Fig. 2-5). The NO-MOTION BYPASS switch, on the engineer's right switch panel, is used to bypass a wrong motion signal from the ATC that could prevent operation of the side doors.

The engineer can also bypass the speed sensing system by pressing on the NO-MOTION BYPASS switch in case of failure. When the switch is used to bypass a defective speed sensing system, the engineer can:

(1) Charge the brake pipe after an emergency brake.

(2) Reset, or close, the MCB after an emergency brake.

(3) Apply the parking brake.

(4) Extend the mirrors momentarily, if the MIRRORS (PUSH TO RETRACT) switch is held in OUT position.

2.1.6.4 Door Control Station (Fig. 2-23). The side doors close automatically when the car electrical power and pneumatics are available. Each side door is controlled by an adjacent Door Control Station (DCS). Only one DCS can be active at any time. The DCS is activated by a standard coach key. It provides the following indications and controls:

- DCS key switch: Activates the DCS in ON position to allow control of all the side doors on the same side of the train. In OFF position, the DCS is deactivated and has no control over the side doors. All monitoring functions remain active and the local door responds to trainlined or local commands. In isolated (ISOL) position, the DCS, local side door, and crew switches are out of service. This position is to be used when a DCS fault could affect the operation of the other train doors.

NOTE:

Only one DCS can be active at any time on one side of the train. When the key switch is set to the ON position, a check is automatically made to ensure that no other DCS is active on the same side of the train, the DCS ACTIVE indicator turns on to show that the DCS controls the associated doors.

- Interior CREW key switch: Opens the local side door in OPEN position. In CLOSE position, the local side door closes and locks.

NOTE:

The key must be brought back to the center position before the command is initiated. This switch is active only when the train is stationary and the DOOR OPEN switch in the cab is not in the INHIBIT position.

- DIAGNOSTIC CONNECTOR: Provides the interface for the portable test equipment used by maintenance personnel.
- HEALTHY indicator: On when the DCS is functioning properly.

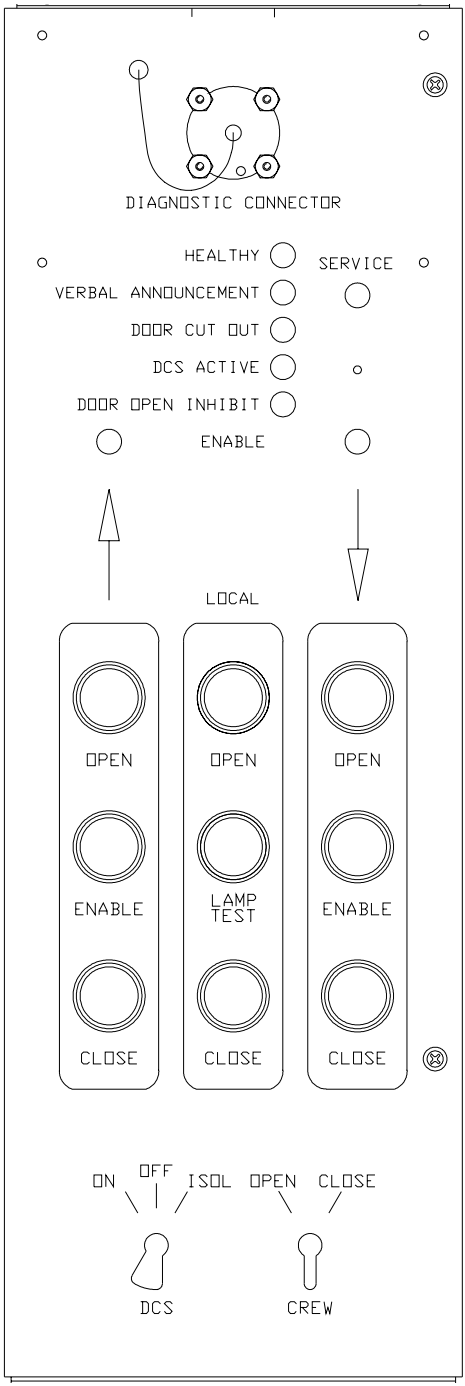


Figure 2-23
Door Control Station (DCS)

- VERBAL ANNOUNCEMENT indicator: On when a verbal announcement is in progress. Further door close commands and announcements are inhibited. Flashes to indicate fault conditions.
- DOOR CUTOUT indicator: On when the local side door is out of service.
- DCS ACTIVE indicator: On when the DCS is the active one.
- DOOR OPEN INHIBIT indicator: On when the engineer has inhibited side door operation.
- ENABLE indicator: On when the associated ENABLE pushbutton has been pressed. The doors forward or rearward of the DCS can be opened by pressing on the appropriate passenger OPEN pushbutton.
- SERVICE indicator: Used for communications system diagnostics. It is not illuminated during normal service.
- Forward OPEN pushbutton: Opens all the doors forward of the DCS on the same side. Not active until the associated LOCAL OPEN pushbutton has been pressed.
- LOCAL OPEN pushbutton: Opens the associated local door. Forward and rearward OPEN pushbuttons are not active until the associated OPEN pushbutton has been pressed.
- Rearward OPEN pushbutton: Opens all the doors rearward of the DCS on the same side. This pushbutton is not active until the associated local OPEN pushbutton has been pressed.
- Forward ENABLE pushbutton: Enables door operation by the PASSENGER OPEN pushbutton forward of the DCS on the same side.
- LAMP TEST pushbutton. Illuminates all the indicators on the DCS to check that they are operational.
- Rearward ENABLE pushbutton: Enables door operation by the PASSENGER OPEN pushbutton rearward of the DCS on the same side.
- Forward CLOSE pushbutton: Initiates the closing of all the train doors on the same side forward of the DCS. (It does not include the local door.)

NOTE:

When the forward CLOSE pushbutton is pressed, an audible tone sounds. A verbal announcement is made at all the appropriate doors before they close. Unless the rearward CLOSE pushbutton is pressed within 0.5 sec. of the forward CLOSE pushbutton, the rearward CLOSE command is delayed until the verbal announcement is complete. The VERBAL ANNOUNCEMENT indicator is illuminated when the CLOSE command is delayed.

- LOCAL CLOSE pushbutton: Closes the associated local door. When the LOCAL CLOSE pushbutton is pressed, an audible tone sounds before the door closes.
- Rearward CLOSE pushbutton: Initiates the closing of all the doors rearward of the DCS on the same side (It does not include the local door.)
- Speaker: Provides audible warning tone for about two seconds when the local side door is about to close.

2.1.6.5 Exterior Crew Key Switches. An exterior crew key switch is provided at each side door location. The crew switch is operated using a standard coach key. In OPEN position, the local side door opens and remains open. In CLOSE position, the local door closes and locks.

2.1.6.6 Passenger Side Door Open Pushbutton. An illuminated pushbutton is located in the vestibule. The pushbutton is illuminated when an enable trainline is initiated. Any passenger can then open the door locally by pressing the pushbutton. The door remains open until a door close pushbutton is pressed on the local DCS or from a trainline command.

2.1.6.7 Collision Post and Body End Doors Controls. The interior doors (body end door and collision post door) are pneumatically activated and their operation is electrically initiated and monitored. Their controls are as follows:

- Interior Door Control Unit: Controls the opening and closing of the associated doorset.
- Infrared proximity detectors: There is one on either side of the interior doorset. They generate a door open signal when a passenger is detected at the door.
- Door open pushbuttons: Enable the doors to be opened manually as required in the event of failure of the infrared sensors.

The doors can be operated in one of the three modes selected by the mode selector switch located on either side of the interior doorset. The modes are:

- Automatic: The doors take 2 seconds to open, remain open for 8 to 10 seconds and then close. If the opening speed time is detected as being excessive, the doors cycle open. If the adjacent side door is open when the interior door is opened, the interior doors open and remain open for 30 seconds after the side door has closed, or for 5 to 6 minutes, whichever occurs first.
- Open: The doors are driven to the open position. They then remain open until another mode of operation is selected.
- Manual: Electrical and pneumatic power is removed from the doors. They can then be opened and closed by hand.

2.1.7 HEATING, VENTILATION, AND AIR CONDITIONING (Fig. 2-24). The following subsections describe the Heating, Ventilation, and Air Conditioning (HVAC) system controls and indicators.

2.1.7.1 A/C Switch. The A/C switch, on the engineer's center console switch panel, controls the air conditioning in the cab. Switch settings are as follows:

- OFF: Air conditioning unit not operational (no air conditioning, blower, or overhead heating available). Cab heaters functional if cab heater switch set to HEAT.
- AUTO: All functions can operate, depending on other switches positions and ambient and return air temperatures. The HVAC test switch must be set to AUTO. Cab heaters are also functional if the cab heater switch is set to HEAT.

2.1.7.2 CAB HEATER Switch. The CAB HEATER switch, located on the engineer's center console switch panel, controls both cab heaters located under the console in the cab side walls. Switch settings are as follows:

- OFF: Cab heaters are not available.

- HEAT: Cab heaters are functional regardless of the A/C test switch position. The return air sensor (located inside the return air grille) controls the operation of cab heaters if the A/C test switch is set to AUTO and the cab heat sensor (on the cab wall) controls the operation of cab heaters if the A/C test switch is set to OFF.
- LAYOVER: The air conditioning unit turns OFF automatically and both cab heaters remains operational to provide an interior temperature of 45 °F.

2.1.7.3 DEFROST Switch. The DEFROST switch, on the engineer's center console switch panel, controls windshield defrosting with the following settings:

- OFF: No defrost available.
- FAN: Fan blows air on the windshield interior side.
- HEAT: Fan blows heater air on the windshield interior side.

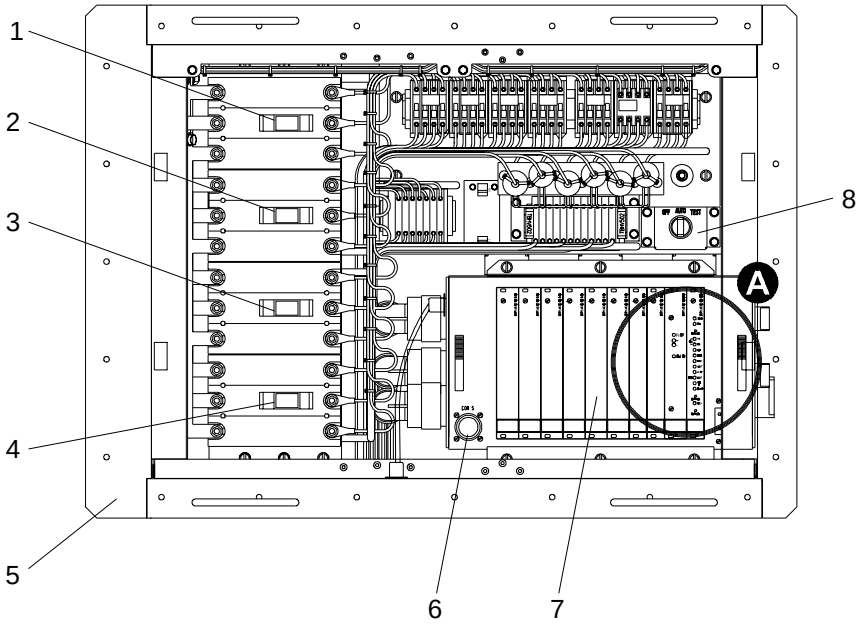
2.1.7.4 WINDSHIELD HEAT Switch. The windshield heat switch, on the engineer's center console switch panel, turns the windshield heater on or off.

2.1.7.5 Cab Temperature Selector. The cab temperature selector, labeled CAB °F on the engineer's center console switch panel, adjusts the cab temperature from 65 °F to 75 ° F. It is inoperative if the CAB HEATER and A/C switches are OFF.

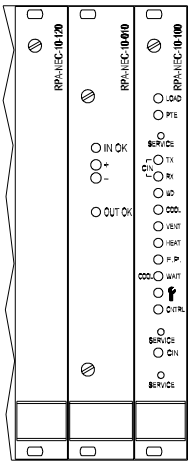
2.1.7.6 Temperature Control Unit (Fig. 2-24). Each car HVAC Unit is controlled by a dedicated Temperature Control Unit (TCU) located inside the HVAC Unit. The TCU controls all the subsystems in the HVAC system. It is energized whenever the 120 Vac power is available.

The TCU is equipped with LEDs that provide indications on the HVAC system operation. The following LEDs provide the most important indications to enable a quick diagnostic of the system status:

LOAD:	Green, On when the TCU outputs are enabled.
CNTRL:	Red, On when the Central Processing Unit (CPU) requires service.
TX:	Yellow, On when the TCU transmits to the car internal network.
RX:	Yellow, changes state periodically (5 seconds). Steady state indicates TCU not communicating with the monitoring system.
COOL:	Green, On in air conditioning mode.
VENT:	Green, On in ventilation mode.
HEAT:	Green, On in layover or in heating mode.
F.P.:	Green, On when the freeze protection is activated.
COOL WAIT:	Red, On when the compressor is inhibited.
MAINT:	Red, On when the TCU or HVAC is in an abnormal condition.
CIN:	Red, On when the network interface requires servicing.
72 Vac:	Green, On when the TCU is receiving 72 Vac.
120 Vac:	Green, On when the TCU is receiving 120 Vac.
IN:	Green, On when input power is in range.
OUT:	Green, On when output power is in range.



1. Blower Motor Miniature Circuit Breaker 1 (MCB1)
2. Condenser Motor Miniature Circuit Breaker 2 (MCB2)
3. A/C Compressor Miniature Circuit Breaker 3 (MCB3)
4. Overhead Heaters Miniature Circuit Breaker 4 (MCB4)
5. HVAC Temperature Control Box
6. PTE Connector
7. Temperature Control Unit
8. HVAC Test Switch



DETAIL A

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Figure 2-24
HVAC Temperature Control Box, with Temperature Control Unit

2.1.7.7 Power Car HVAC Test Switch (Fig. 2-24). This switch is located inside the HVAC electrical control box, above the TCU. Its settings are as follows:

- OFF: No air conditioning is available in this position.
- AUTO: This is the normal switch position. Air conditioning is enabled.
- TEST: When the switch is held on this position (for maintenance purpose only), both the refrigerant compressor and the condenser fan motor are running. When released, the switch returns to AUTO.

2.1.7.8 Power Car Freeze Protection. Freeze protection is controlled automatically by the TCU and enabled whenever the ambient temperature falls below 45 ^{o}F.

2.1.7.9 Power Car Toilet Thermostat. In the toilet module, the toilet forced air heater is controlled by a local temperature controller and a temperature sensor.

2.1.7.10 Temperature Control Switch (Fig. 2-15). The temperature control switch of each passenger car is located inside the electrical locker. The switch settings are as follows:

- NORMAL: Car temperature maintained as per the normal setting.
- LOW: Car temperature maintained as per the normal setting, minus 3 ^{o}F.
- HIGH: Car temperature maintained as per the normal setting, plus 3 ^{o}F.
- LAYOVER: Cooling system switched off, overhead heating disabled, fresh air dampers closed, interior temperature maintained above 45 ^{o}F.

2.1.7.11 Passenger Car Air Conditioning Test Switch (Fig. 2-24). The air conditioning test switch settings are as follows:

- OFF: Cooling mode is disabled by the temperature control unit. The blower fan is operational.
- AUTO: The HVAC unit is operating normally.
- TEST: The system is in full cooling mode independently of the temperature control chart. This mode remains as long as the switch is kept in the TEST position.

2.1.7.12 Emergency Blower Fan Switch (Fig. 1-19, 1-22, 1-25, and 1-28). There are two emergency blower fan switches for each passenger car, one in each vestibule. Once a switch is set in CUT-OUT position, it cuts out the 120 Vac power to the blower fans. To restart the fans, both switches have to be set to NORMAL position.

2.1.7.13 Service Cutout Switch. This switch is useful for the maintenance personnel working from outside. It is located in the evaporator/heater/blower section. Switch settings are as follows:

- RUN: The HVAC unit is operating normally.
- OFF: The 120 Vac control supply is removed and all outputs internal to the HVAC unit are therefore de-energized. The cooling system shuts down immediately.

2.1.7.14 FRESH AIR DAMPERS Switch (Fig. 2-10). The FRESH AIR DAMPERS momentary switch on the engineer's overhead switch panel controls the opening or closing of the passenger cars fresh air dampers. When the switch is activated, the power car temperature control unit records the command to force open or close the dampers and communicates it to all other cars in the trainset. Each TCU initiates a timer to revert to automatic damper control after one hour.

2.1.8 COMMUNICATION SYSTEMS (Fig. 2-25 to 2-33). The communication systems controls and indicators available to the trainset crew are detailed in the following subsections.

2.1.8.1 Engineer's Microphone. The engineer's microphone is mounted inside the cab console, between MFD1 and POD. It is used for IC and radio transmission. It is activated with the communication footswitch.

2.1.8.2 Engineer's Headset Jack. The engineer's headset jack is mounted on the engineer's center console switch panel, to the right of the remote control head, and is used to plug in a headset.

2.1.8.3 Communication Footswitch. The communication footswitch located under the cab console is a PTT used by the engineer for IC and radio mode of operation.

2.1.8.4 Remote Control Head (Fig. 2-28). The remote control head, located on the engineer's center console switch panel, is the radio extension. It includes the following controls and features:

- Numeric Keypad: 12-digit (numeric) keypad normally used to transmit DTMF dispatch call tones. Also used to enter channel, home, or tone numbers when in the corresponding select mode.
- CHAN button: Initiates the channel select mode for entry of TX and RX channels from the numeric keypad.
- DTMF button: Initiates the dispatch DTMF select mode to select and transmit a DTMF dispatch tone by means of the numeric keypad.
- TONE button: Initiates the dispatch tone select mode to select and transmit a singletone dispatch tone by means of the numeric keypad.
- HOME button: Initiates the home channel select prompt for entry of a programmed home channel from the numeric keypad.
- RAD button: Used to select radio mode of operation.
- PA button: PA used to enable public address.
- IC button: Used to select IC mode of operation.
- CALL button: Used to generate IC call chime in all trainset interior speakers.
- DISP button: Retransmits the preselected tone (DTMF or singletone) indicated in the DISP T/D display.
- VOL control: This rocker switch controls the remote control head speaker radio volume level.

- PTT button: When pressed and held down, enables the remote control head microphone to transmit voice messages.
- Microphone: Used to transmit voice radio messages.
- Speaker: Used for received radio messages only (always enabled).

The remote control head also provides the following indicators and displays:

- TX indicator: Comes on yellow whenever transmission occurs (PTT or dispatch calls).
- VOLUME display: Indicates relative volume level within a 0 (minimum) to 10 (maximum) range.
- DISP T/D display: Indicates the selected dispatch tone ("T" for singletone and "D" for DTMF) with the chosen tone number.
- TX display: Indicates the current transmitter channel selection.
- RX display: Indicates the current receiver channel display.
- HOME display: Indicates the current home channel selection (left blank if no home channel is selected).

2.1.8.5 Assistant's Headset Station (Fig. 2-29). The assistant's headset station includes the following features:

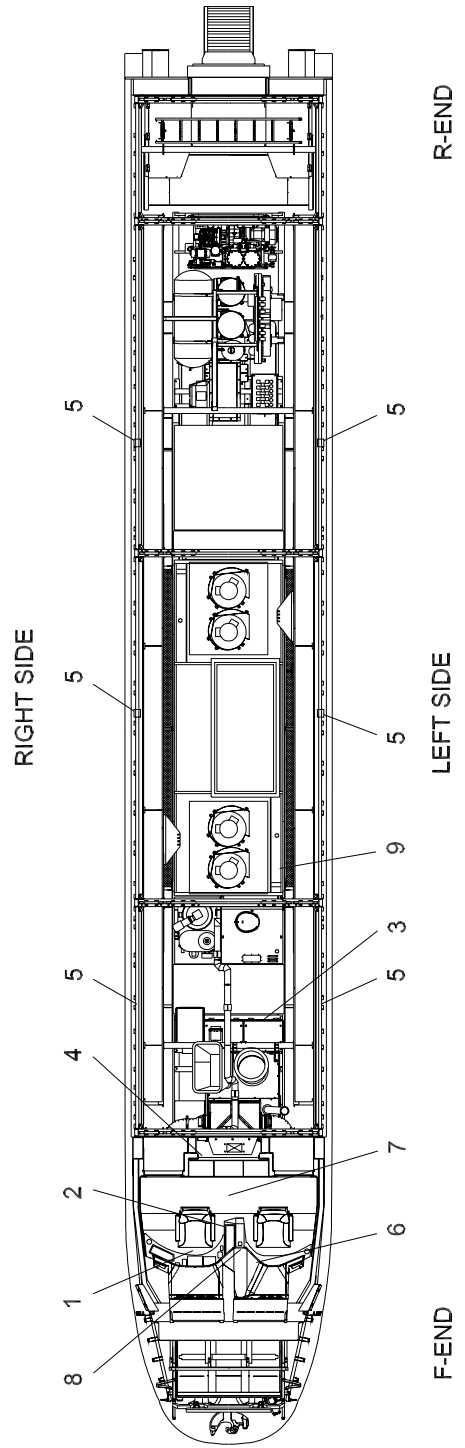
- Headset Jack. Provides a jack access to the assistant's headset.
- PTT button for PA, IC, and radio modes of operation
- Microphone for PA, IC, and radio modes of operation
- LEDs for mode monitoring
- Volume control knob for the Cab Speaker
- Mode selector button for PA, IC, and radio modes of operation.

2.1.8.6 Remote Stations. Six remote stations are located in the power car equipment room. They allow IC communication between maintenance personnel in the equipment room and crew members in the cab during maintenance activities. Their enclosures provide an access for the headset jack.

2.1.8.7 Passenger Control Units (Fig. 2-26). A passenger control unit is installed in the armrest of each seat and at ADA locations. Each module receives five audio channels: three stereophonic (from the compact disc player) and two monophonic (from digital video disc and VHS).

2.1.8.8 Attendant Call System (Fig. 2-26 and 2-27). The attendant call system uses the bulkhead displays and the attendant call annunciation panels to inform the crew members that an attendant call button has been pressed. The various controls and indicators related to this system are described below:

2.1.8.8.1 Attendant Call Button (Fig. 2-26 and 2-27). The attendant call button is a red mushroom pushbutton. There is one in each conventional rest room (two in each ADA rest room) and in all ADA locations of the trainset (two in the cafe car, six in each coach car, five in the end coach car and first class car).



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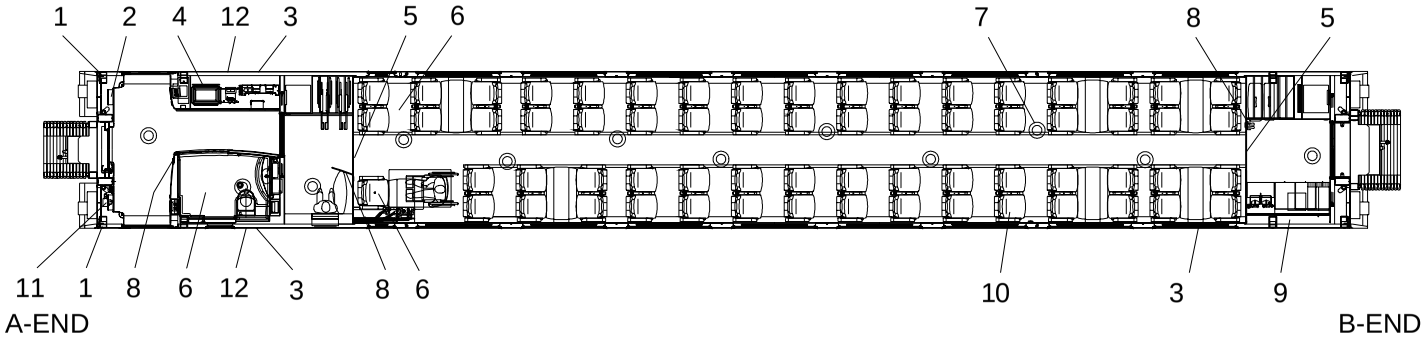
1. Communication Footswitch
2. Remote Control Head
3. Power Car Communication Control Unit
4. Radio
5. Remote Station
6. Assistant's Headset Station
7. Cab Speaker
8. Radio Battery Charger
9. Voice Radio Antenna

Figure 2-25
Power Car Communication Systems Component Location



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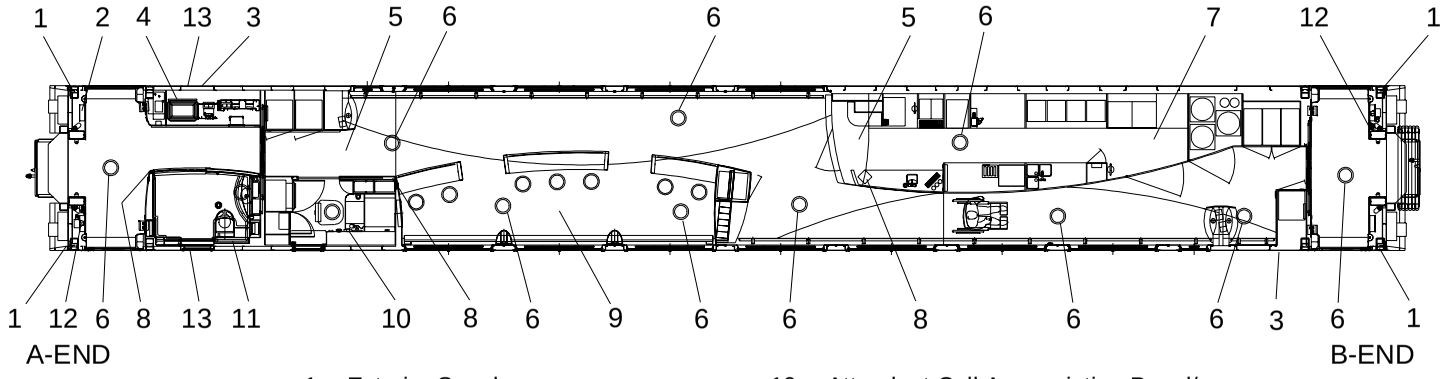
1. Exterior Speaker
2. Route Display Sign
3. Exterior Display Sign
4. Communication Control Unit/ Passenger Control Units Power Supply
5. General Information Display Sign
6. Attendant Call Button
7. Interior Speaker
8. Bulkhead Display Sign Phone-Toilet
9. Attendant Call Annunciation Panel
10. Seat Location Display/Passenger Control Unit/ Entertainment Seek Control Unit (1 each per 2 seats)
11. Communication Station
12. Emergency Rescue Station

Figure 2-26
Passenger Car Communication Systems Component Location - Typical



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1. Exterior Speaker
2. Route Display Sign
3. Exterior Display Sign
4. Bistro Communication Control Unit/ Prerecorded Announcement System
5. General Information Display Sign
6. Interior Speaker
7. Attendant Call Annunciation Panel/ Communication Station
8. Bulkhead Display Sign Phone-Toilet
9. Television Monitor
10. Attendant Call Annunciation Panel/ Compact Disc Player/ Signs - Automatic Announcement Menu/ Radio Battery Box/ Radio Battery Charger/ Voice Radio Antenna/ Communication Station/ Cafe Radio/ Video System/
11. Attendant Call Button
12. Communication Station
13. Emergency Rescue Station

Figure 2-27
Cafe Car Communication Systems Component Location

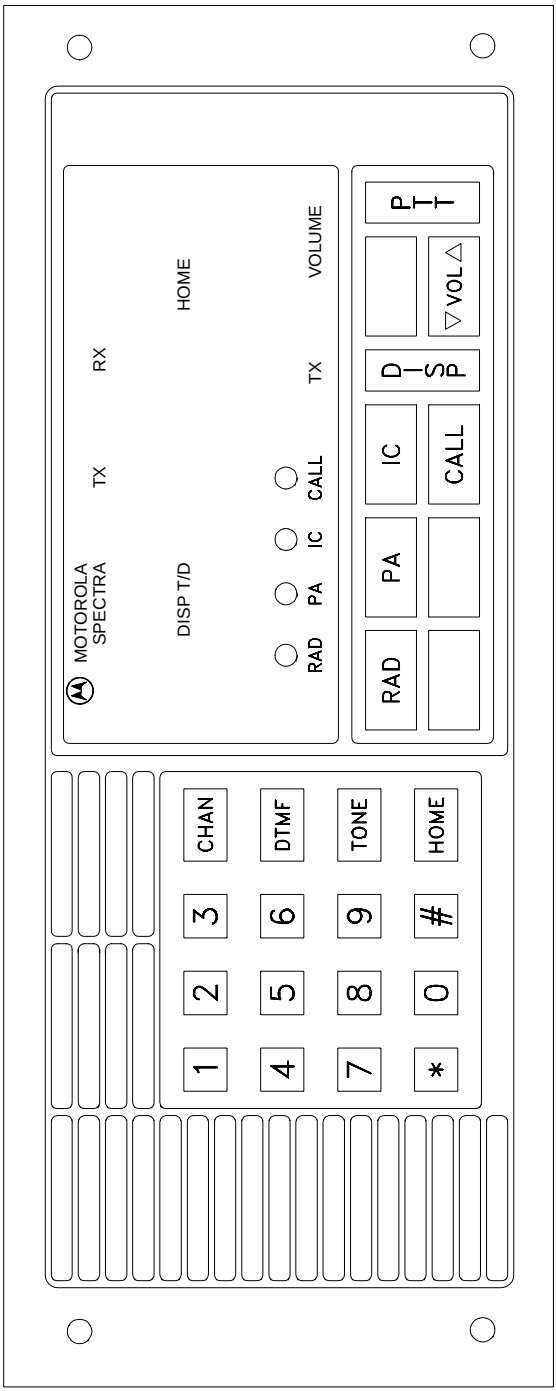

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Figure 2-28
Remote Control Head

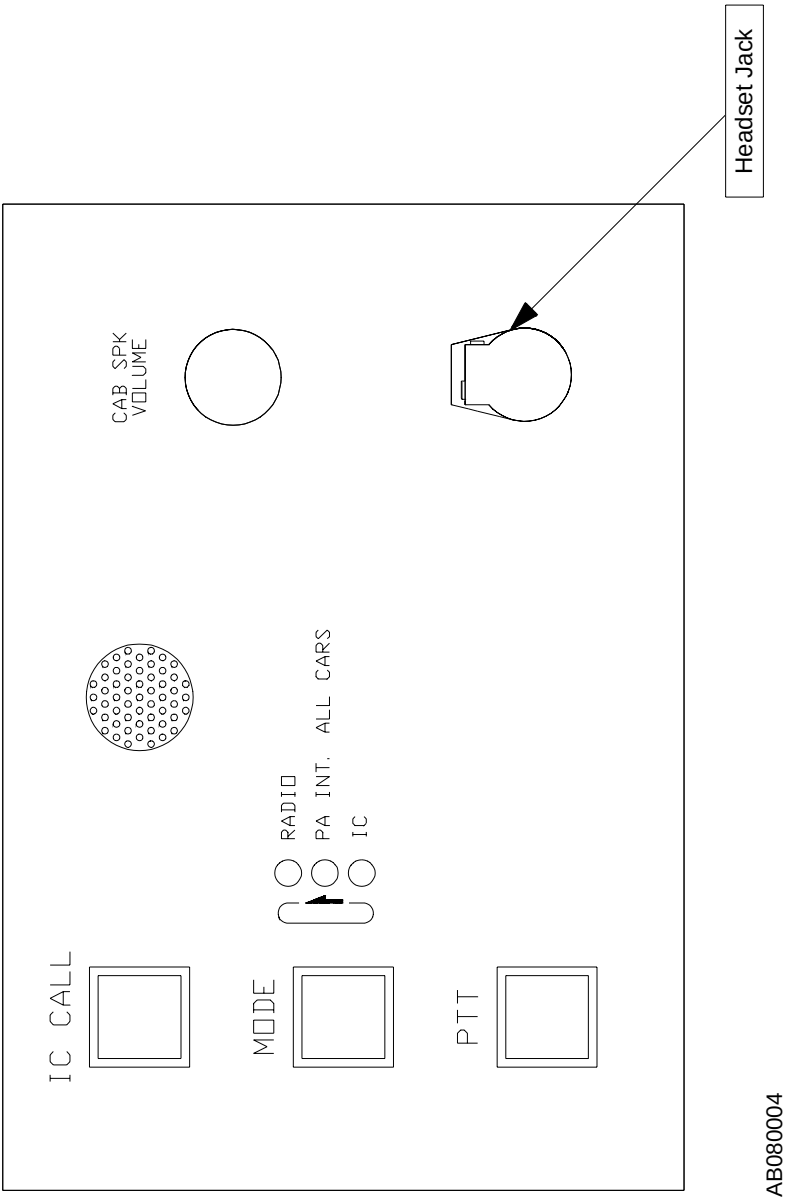

Figure 2-29
Assistant's Headset Station

2.1.8.8.2 Attendant Call Annunciation Panel (Fig. 2-26 and 2-27). The attendant call annunciation panel centralizes all the attendant calls of the trainset. It displays the origin (car and area in the car) of each attendant call. It also emits a sound when an attendant call button has been pressed, and the sound is emitted every 15 seconds as long as there are attendant calls. There is one panel in each galley and one in the crew office of the cafe car, for a total of four in the trainset.

2.1.8.8.3 Bulkhead Display Signs (Fig. 2-26 and 2-27). The various bulkhead display signs are used by the attendant call system and the passenger information system. Depending on the location and the type of car, it can have one ADA toilet room indicator, one attendant calls (for ADA locations) indicator, and/or one telecommunication center availability indicator or standard toilet room indicator. At every location, a red light flashes to inform the crew members when an attendant call button has been pressed.

2.1.8.9 General Information Display (Fig. 2-26 and 2-27). The information displayed on the general information display is selected from the crew office Multifunction Display Cafe (MFDB). Refer to Subsection 2.1.12.9, on page 2-114, "Multifunction Display Cafe (Fig. 2-82 to 2-87)" for a description of this equipment.

2.1.8.10 Communication Control Unit (Fig. 2-30). There is one communication control unit per car. In all passenger cars, it is identified as the Communication Control Unit (CCU). In the power car it is called the Power Car Communication Control Unit (PCCU), and is known as Bistro Communication Control Unit (BCCU) in the cafe car.

Each communication control unit exchanges signals with the other trainset control units. All the communication control units are used for data exchange with the Car Monitoring Unit (CMU). Each communication control unit includes a TEST pushbutton for performing self-test and a LED display panel.

2.1.8.11 Cafe Radio - (BRAD, Bistro Radio) (Fig. 2-31). The radio installed in the crew office of the cafe car is a two-way radio frequency communication unit. The low power two way repeater radio is used for communication with the trainset handheld radios. The high power two way radio is used for communication with the wayside radios. The cafe car radio comprises the following equipment:

- Control head, with PWR, Mode, Vol, DIM, VRS, XMT, and Busy functions that work as indicator lights
- PTT pushbutton that allows the user to transmit voice to the repeater radio and the wayside.
- Microphone,
- Speaker.

NOTE:

The radio can communicate with the trainset hand-held radios and wayside radios.

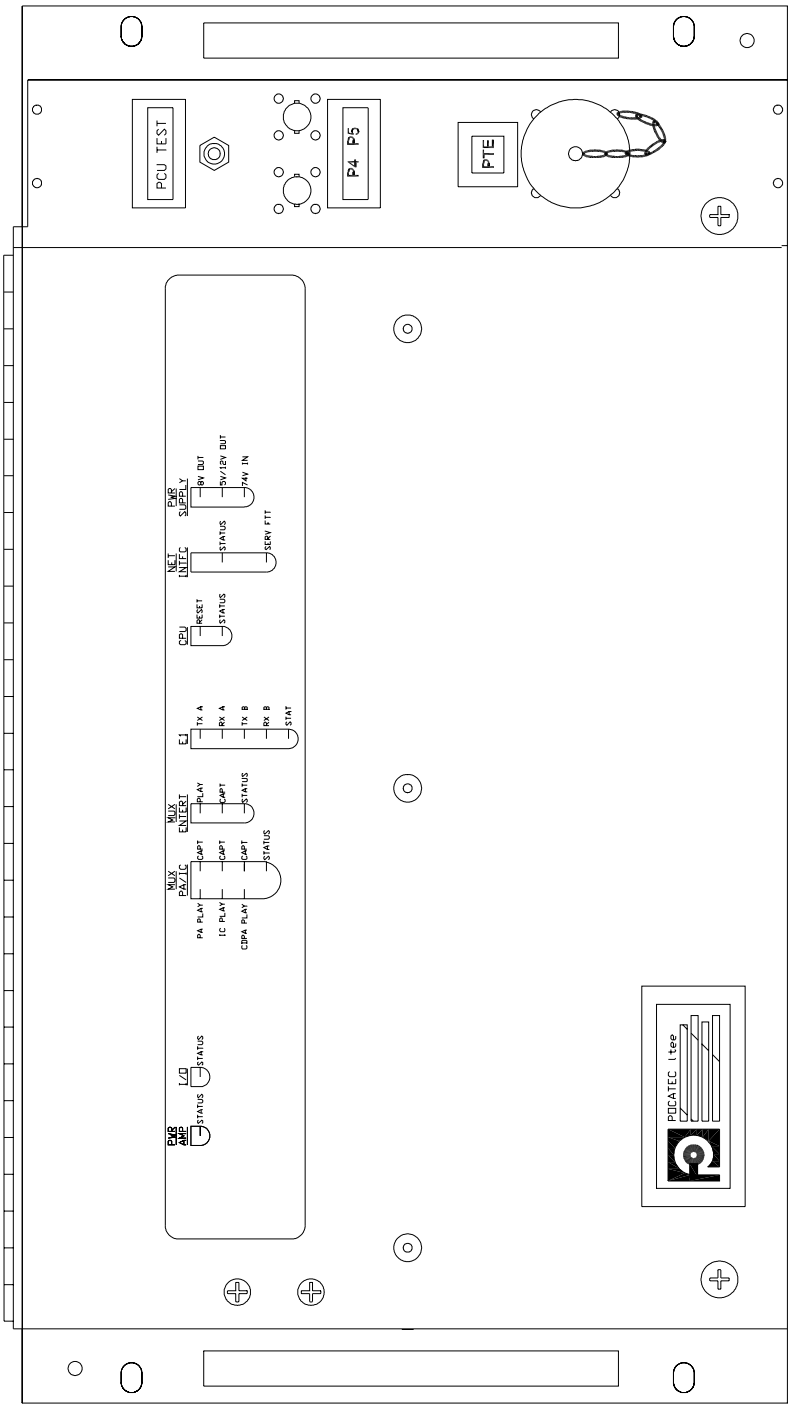

Figure 2-30
Communication Control Unit

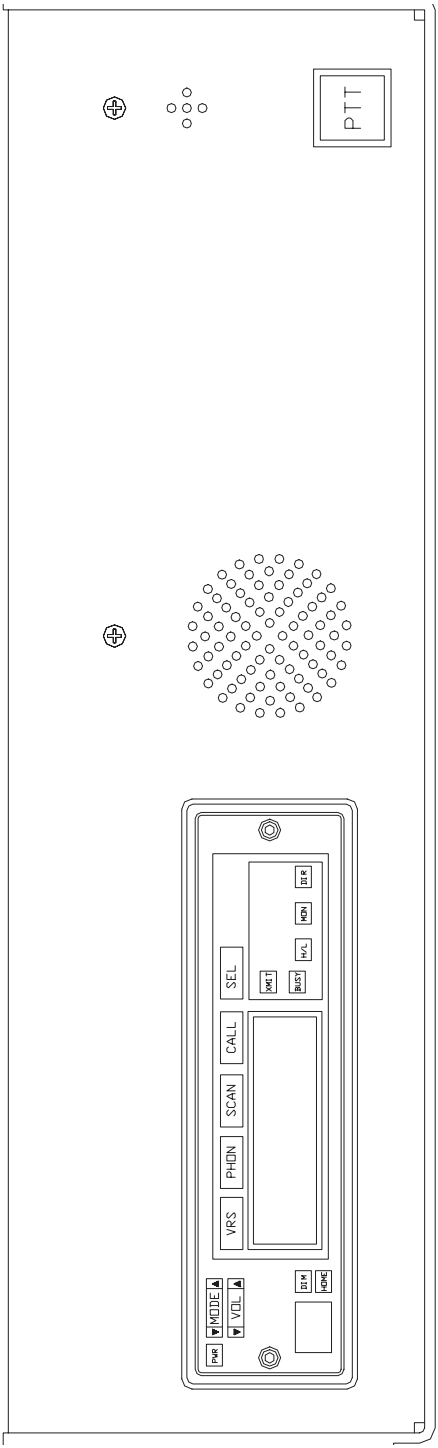

Figure 2-31
Cafe Radio - (BRAD, Bistro Radio)

2.1.8.12 Communication Station (Fig. 2-32). The communication station allows crew members to send/receive IC messages and make PA announcements. There is one communication station per car in the end coach car and first class car, two in the coach car, and three in the cafe car. The communication station comprises the following equipment:

- Handset with push-to-talk (PTT) pushbutton
- MODE pushbutton, to allow selection of IC or PA communication
- IC CALL pushbutton
- Mode indicator LED panel that indicates the mode of communication selected (PA or IC) and the various zones that can be selected for PA communication.

2.1.8.13 Emergency Rescue Station. Two emergency rescue stations are installed outside each passenger car, one on each side, near the A-End exterior emergency door release handle. The emergency rescue station, labelled "EMERGENCY Communication", is made up of a PTT button and a microphone that can be used to transmit a PA announcement to all the trainset interior speakers.

2.1.8.13.1 Seat Location Display. At each seat location, a seat location display shows the origin and the destination of every passenger. It also displays the following information:

- *EMPTY*: to inform that the corresponding seat is unoccupied.
- (********): Asterisks are displayed on the right side when a seat location display is associated to only one seat (first class car only).

2.1.8.13.2 Hand Held Instrument (Fig. 2-33). It is possible to modify the information displayed on the seat location display with the hand held instrument, but the changes are not reflected elsewhere. The hand held instrument has the following five buttons:

- PASS A / PASS W: Sets the seat location display in passenger selection mode. Allows the right side or the left side of the seat location display to show the origin and destination of the window or the aisle passenger. Pressing the key again returns the seat location display to display mode.
- ORIG / DEST: In passenger selection mode, sets the seat location display to edit mode and the destination field disappears. Pressing ORIG / DEST again changes the destination.
- UP: This button enables the user to scroll through the possible choices.
- Down: This button enables the user to scroll through the possible choices.
- ENTER: This button permits the acceptance of the new entry.

If no key is pressed within one minute, the seat location display returns automatically to display mode.

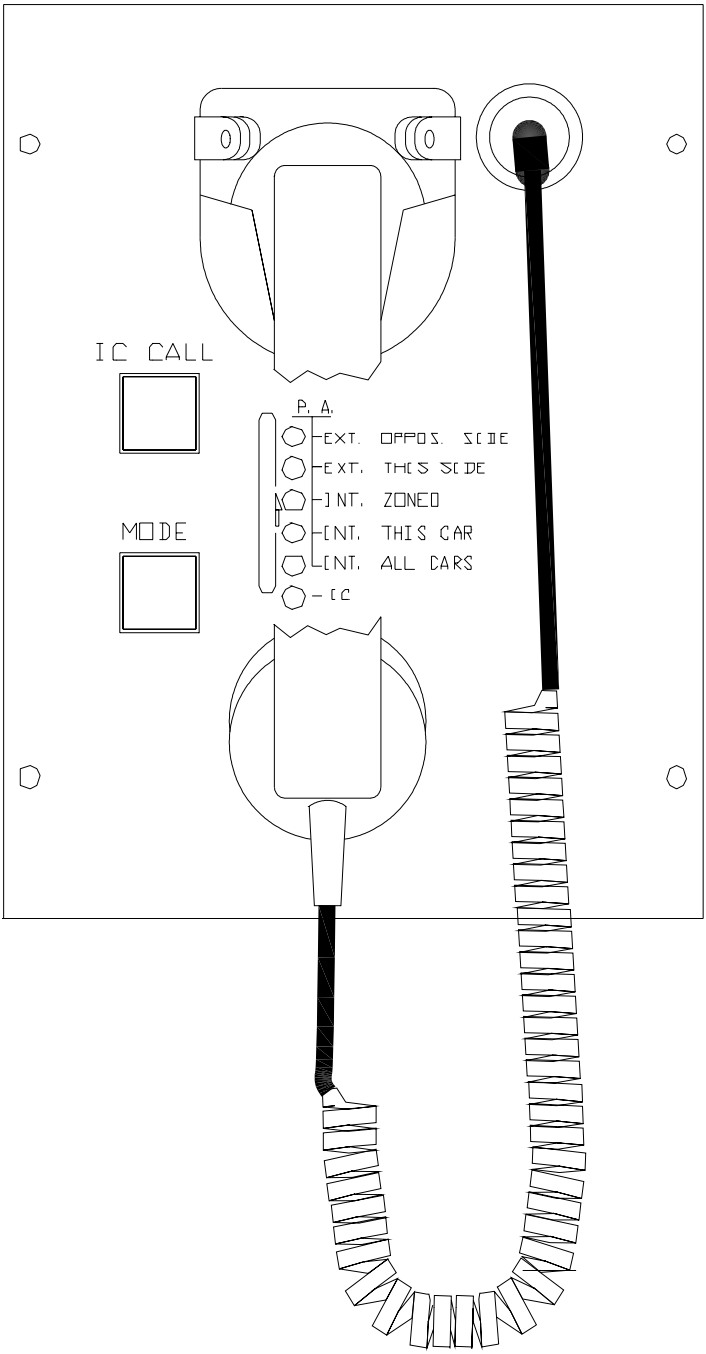

Figure 2-32
Communication Station

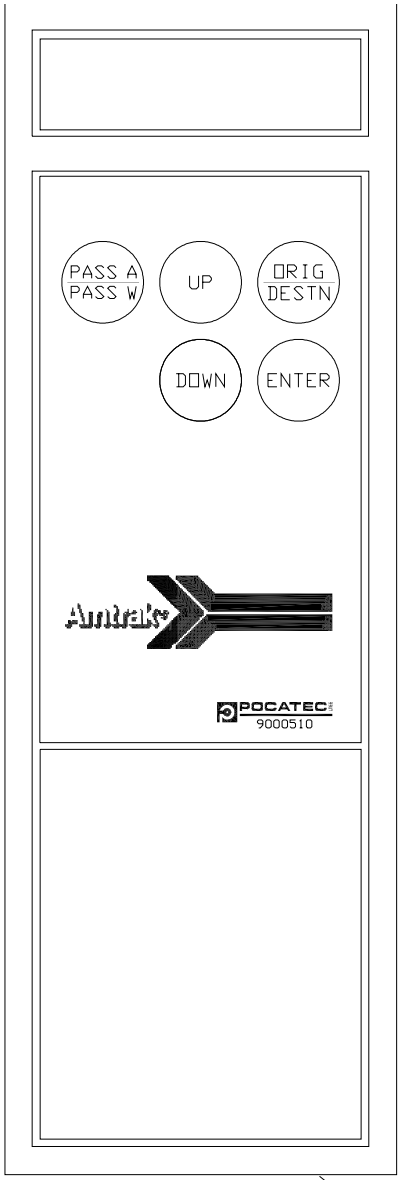

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Figure 2-33
Hand Held Instrument

2.1.9 PROPULSION AND ELECTRIC BRAKING. The propulsion and electric braking controls and indicators are detailed in the following subsections.

2.1.9.1 Key Card Reader. The power car cab is equipped with a key card reader that includes a keypad for entering a Personnel Identification Number (PIN). The reader beeps when a key is pressed and a valid key card has been swiped. The key card must be applied against the reading surface to read the coded data. The data is processed by the monitoring and propulsion systems. The monitoring system logs the data and authorizes different access levels to the monitoring information. The propulsion system authorizes setting the reverser to neutral, forward, or reverse, but traction effort depends on the key card authorization level.

The key card reader incorporates two LEDs and a beeper providing the following operation status:

- Green LED: Illuminates steady when the key card reader is ready to accept a key card. It also blinks/beeps for a period to indicate that a valid key card with the appropriate PIN number has been accepted. The LED comes back steady on to indicate that the key card reader is ready to accept another key card.
- Red LED: Normally turned off, it starts blinking/beeping for a period if an invalid PIN number is entered. It stays on if the key card reader is powered but an internal fault is detected.

The key card reader gives access to different services in each cab of a train consist. The authorization is limited to the cab where the key card has been entered. The highest level authorized for the local cab is displayed on Multifunction Display No. 1 (MFD1) and Multifunction Display No. 2 (MFD2), and logged (level, user ID, time stamp) by the monitoring system. The different levels of authorization are explained in the following subsections.

2.1.9.1.1 Leading Cab Authorization (Table 2-1). Any valid key card and associated PIN turns on MFD2. Level 1 to 3 access authorizes the reverser setting to the N, FWD, or REV position. When the reverser is set, it enables certain cab equipment and controls. The Primary Operating Display, MFD1, Aspect Display Unit, and other console indicators turn on. It also enables pantograph raising.

Table 2-1
Leading Cab Access Levels

LEVEL	DESCRIPTION	REVERSER	DISPLAY
1	Train movement (revenue service) with full access to maintenance data.	FWD, REV, N, OFF	POD, MFD1, MFD2
2	Yard movement with speed limitation by propulsion system; full access to maintenance data.	FWD, REV, N, OFF	POD, MFD1, MFD2
3	Full access to maintenance data, and static motoring test.	FWD, REV, N, OFF	POD, MFD1, MFD2
4	Limited access to maintenance data (manual fault entry).	NONE	MFD2

2.1.9.1.2 Trailing Cab Authorization (Table 2-2). If a cab has already been selected as leading cab, the key card reader gives access to the monitoring system with MFD2, but the reverser remains locked. In a trailing cab, any valid key card and associated PIN turns on the MFD2, but does not authorize reverser operation. Once MFD2 is illuminated, it remains in this condition until the authorization is logged out.

Table 2-2
Trailing Cab Access Levels

LEVEL	DESCRIPTION	REVERSER	DISPLAY
1	Full access to maintenance data	Not allowed	MFD2
2	Full access to maintenance data	Not allowed	MFD2
3	Full access to maintenance data	Not allowed	MFD2
4	Limited access to maintenance data (manual fault entry).	Not allowed	MFD2

2.1.9.1.3 Multiple Access Levels. Up to three users per cab may be authorized in the system if the key card being read is followed by its associated PIN. If the key card is read but the PIN is not entered and another key card is presented, the original key card data is discarded, and replaced by data of the second card. After validation of the key card, it is possible to manipulate the reverser only if all the reversers in the trainset are in OFF position. If another power car cab reverser has been left in another position (condition announced by MFD2), the problem must be corrected first. Correcting the problem automatically unlocks the reverser since the authorization level has already been entered.

NOTE:

If the cab is authorized with the reverser in another position than OFF, and the throttle is in a power position, the throttle must be cycled to “0” and back to power positions to reactivate the propulsion system, and to enable propulsion controls.

2.1.9.1.4 Simultaneous Cab Operation. If the two cabs are occupied in operation, the engineers log their key cards in their respective key card readers, and both reversers are unlocked simultaneously until the first one is set to N, FWD, or REV position. If one cab has the reverser set out of the OFF position, it locks out the opposite cab reverser. When the initial reverser is set back to OFF position, the opposite one becomes unlocked.

Once a cab has been deauthorized (10 seconds after the reverser is moved to OFF), it is necessary to reenter the key card.

2.1.9.2 CAB ACTIVATE Button. The CAB ACTIVATE button, on the cab rear wall switch panel, is used to activate the monitoring system, key card reader, propulsion control, and auxiliary compressor.

2.1.9.3 Key Card Reader Bypass Switch. A key card reader sealed bypass switch is located on the propulsion electrical cubicle in the equipment room. This

bypass switch must be used only in case of a failure of the key card reader, which would prevent cab activation and train operation. This two-position sealed switch provides a level 1 authorization to the power car cab. This condition also illuminates the MFD2 display. Setting the reverser out of the OFF position results in the illumination of Multifunction Display No. 1 (MFD1), Primary Operating Display (POD), and Aspect Display Unit (ADU), and configures the trainlines.

NOTE:

If the key card reader bypass sealed switch is set to BYPASS position while the throttle is in a power position, no power is applied to the traction motors unless the throttle is cycled from “0” to a power position.

2.1.9.4 PANTO-UP Pushbutton (Fig. 2-10). The PANTO-UP pushbutton on the engineer’s overhead switch panel provides a momentary UP trainline command. The resulting action is determined by the setting on the power car PANTOGRAPH LOCAL SELECTOR.

NOTE:

If the pantos up disabled feature of the propulsion system status screen on MFD2 is activated, the pantographs do not raise. (For more details, refer to Subsection 2.1.12.8.2, on page 2-97, "PantoDown Lead PC and PantoDown Trail PC Buttons (Fig. 2-50)".)

2.1.9.5 PANTO-DOWN Pushbutton (Fig. 2-10). The PANTO-DOWN mushroom pushbutton on the engineer’s overhead switch panel is used to control the lowering of the pantographs. To energize the PANTOGRAPH DOWN trainline, the PANTO-DOWN pushbutton must be pressed down. To reset pantograph control, the pushbutton must be pressed down again to restore to normal position.

2.1.9.6 PANTOGRAPH LOCAL SELECTOR (Fig. 2-34). Manual control of the pantograph is possible either from the cab console, or the PANTOGRAPH LOCAL SELECTOR on the propulsion electrical cubicle, or the pantograph pneumatic control panel in the equipment room.

NOTE:

The pantograph is raised from the active cab and lowered from either cab whether active or not.

The PANTOGRAPH LOCAL SELECTOR switch settings are as follows:

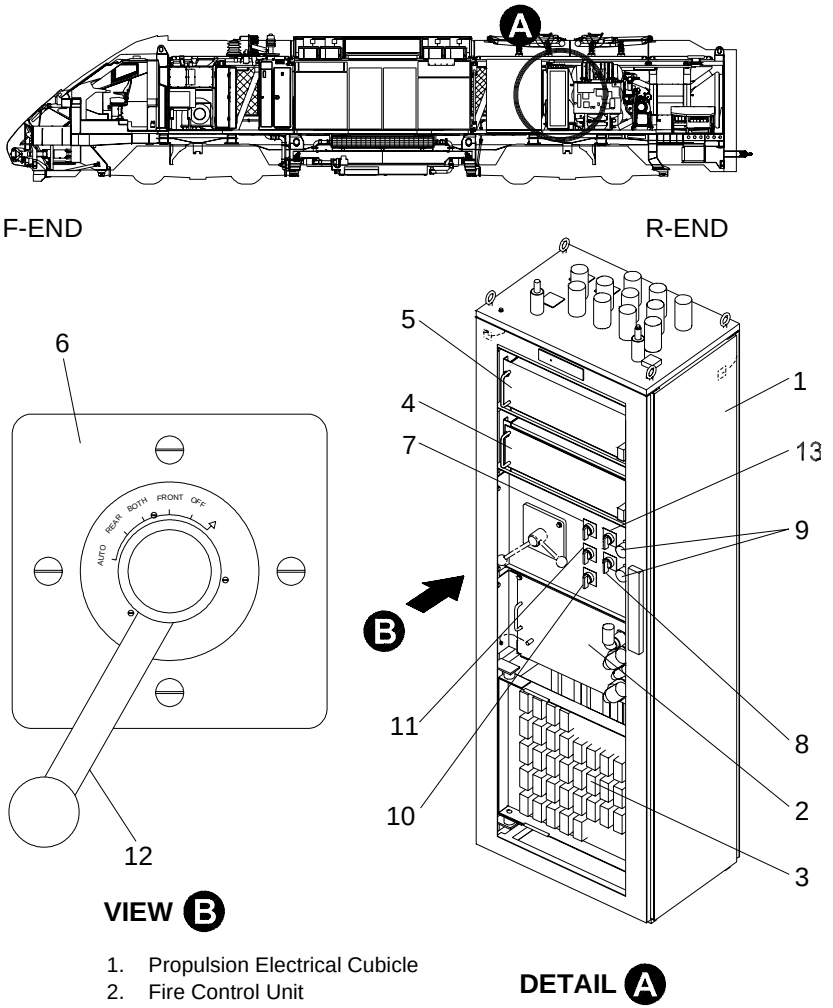
- OFF: Both pantographs remain down or are lowered.
- FRONT: Raises the front pantograph, regardless of active cab location.
- REAR: Raises the rear pantograph, regardless of active cab location.
- BOTH: Raises both pantographs, regardless of active cab location.
- AUTO: Automatic selection of pantographs, based on leading cab activation.

NOTE:

In AUTO position, the selected pantograph is always the trailing pantograph of each power car in the trainset

NOTE:

The main circuit breaker closes only after the pantograph is raised.



1. Propulsion Electrical Cubicle
2. Fire Control Unit
3. Trainline Relay Panel
4. Main Processing Unit No. 2 (MPU2)
5. Main Processing Unit No. 1 (MPU1)
6. Pantograph Local Selector
7. Pantograph Local Control Switch
8. Oil Level Detector Bypass Switch
9. PTE Connector
10. Fire Control Unit Bypass Switch
11. Key Card Reader Bypass Switch
12. Pantograph Switch/Key
13. Pressure Pantograph Switch

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Figure 2-34
Propulsion Electrical Cubicle

2.1.9.7 Pantograph Pneumatic Control Panel (Fig. 2-35). The pantograph pneumatic control panel is equipped with cutout handles that allow the isolation of each pantograph air supply. The cutout handles labelled OUTPUT TO MAXIMUM REACH cut out the air supply to their respective pantograph pneumatic raising cylinder. The cutout handles labelled OUTPUT TO CARBON STRIP cut out the air supply to their respective pantograph carbon strips.

2.1.9.8 Pantograph Automatic Configuration. When an UP command is initiated from an active cab, and all pantograph local selectors are set to AUTO position, one pantograph per power car raises. The selected pantograph is always the trailing pantograph of each car in the trainset. This configuration remains valid until the trainset is operated from the opposite end power car.

When the engineer sets the reverser to OFF position, the trainset is still powered from the catenary, and no change occurs in the trainset high voltage configuration until the opposite cab is activated. When the opposite cab is activated, the lowered pantographs raise, and the raised pantographs are then lowered. This automatically reverses the previous pantograph configuration.

2.1.9.9 Pantograph Local Control Switch (Fig. 2-34). The pantograph local control switch, on the propulsion electrical cubicle, allows rear pantograph raising, when the grounding switch is activated, to ground the catenary. The use of the access hatch to the roof is not possible when the switch is in GROUND position.

2.1.9.10 Pressure Pantograph Switch (Fig. 2-34). the pressure pantograph switch, on the propulsion electrical cubicle, allows selection of the operational pressures for the pantographs. the trainset pantographs are raised with a pressure of 22.5 psi or 27 psi according to the position of the switch:

- HIGH: Sets the pantograph contact pressure to 27 psi, regardless of the power car position in the train.
- NORMAL: Sets the pantograph contact pressure to 22.5 psi.
- AUTO: Sets the lead power car pantograph to 22.5 psi, and the remaining pantographs at 27 psi.

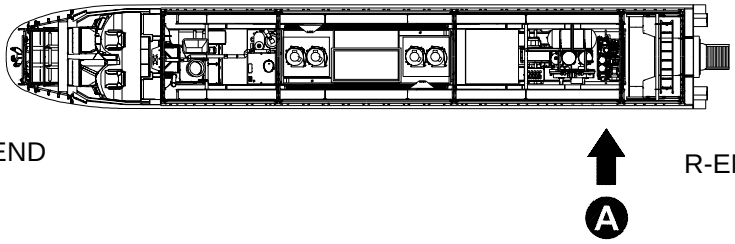
2.1.9.11 Main Circuit Breaker Switch (Fig. 2-10). The main circuit breaker is controlled by the MCB switch on the engineer's overhead switch panel. In AUTO position, the switch allows for future automatic reconfiguration of high-power hardware, such as the main transformer primary, when there is catenary nominal voltage transition. The OPEN position allows the manual reconfiguration of high-power hardware by opening the main circuit breaker.

NOTE:

In the future, the MCB will be automatically controlled by the lead power car ACSES system that will open, and authorize reclosing, as instructed by wayside transponders. (The manual mode is used to replace an operational ACSES system.)

NOTE:

The main circuit breakers of each power car closes automatically at power-up.



F-END

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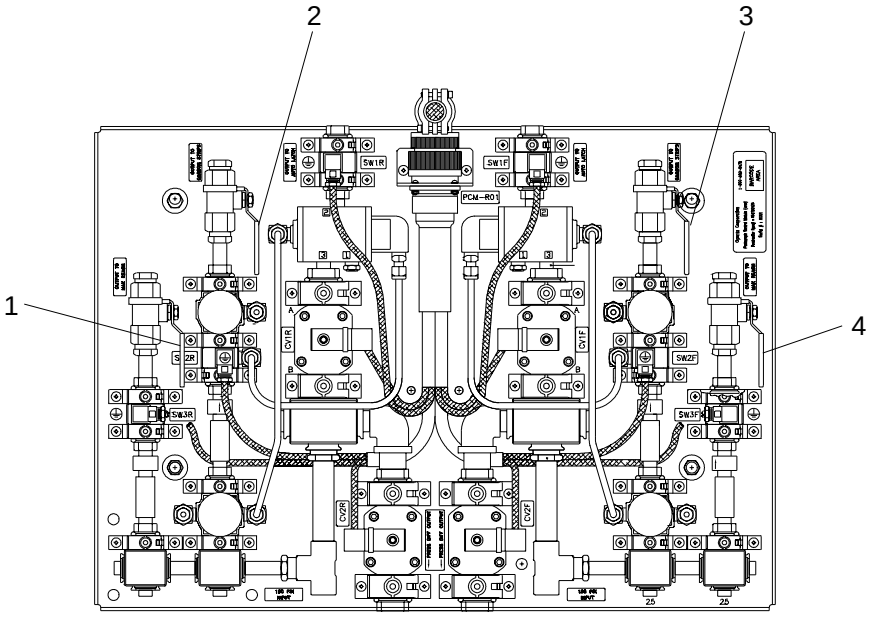


VIEW A

AB090001

1. Front Pantograph Output to Maximum Reach Cutout Handle
2. Front Pantograph Output to Carbon Strip Cutout Handle
3. Rear Pantograph Output to Maximum Reach Cutout Handle
4. Rear Pantograph Output to Carbon Strip Cutout Handle

Figure 2-35
Pantograph Pneumatic Control Panel

The following conditions either prevent closure or open the circuit breaker if closed:

- Main circuit breaker switch in OPEN position
- Overcurrent detected in main transformer primary
- No current return to ground
- Inverter or rectifier bridge failure
- Overtemperature detected in main transformer
- Fire detected
- EMI limit exceeded
- Pantograph DOWN command detected
- Insufficient air pressure
- Propulsion (PECU) main circuit breaker close command not present.

2.1.9.12 Pantograph Pressures. The pressures related to the operation of the pantograph are as follows:

- Air pressure going to the pantograph: 150 psi
- Minimum pressure: 65 to 70 psi
- Pressure required to close the Main Circuit Breaker: 95 psi
- Regulator to carbon strip pressure: 43. 5 psi.

When the main reservoir air pressure is too low, the auxiliary air compressor automatically supplies the air required to raise the pantograph and close the main circuit breaker.

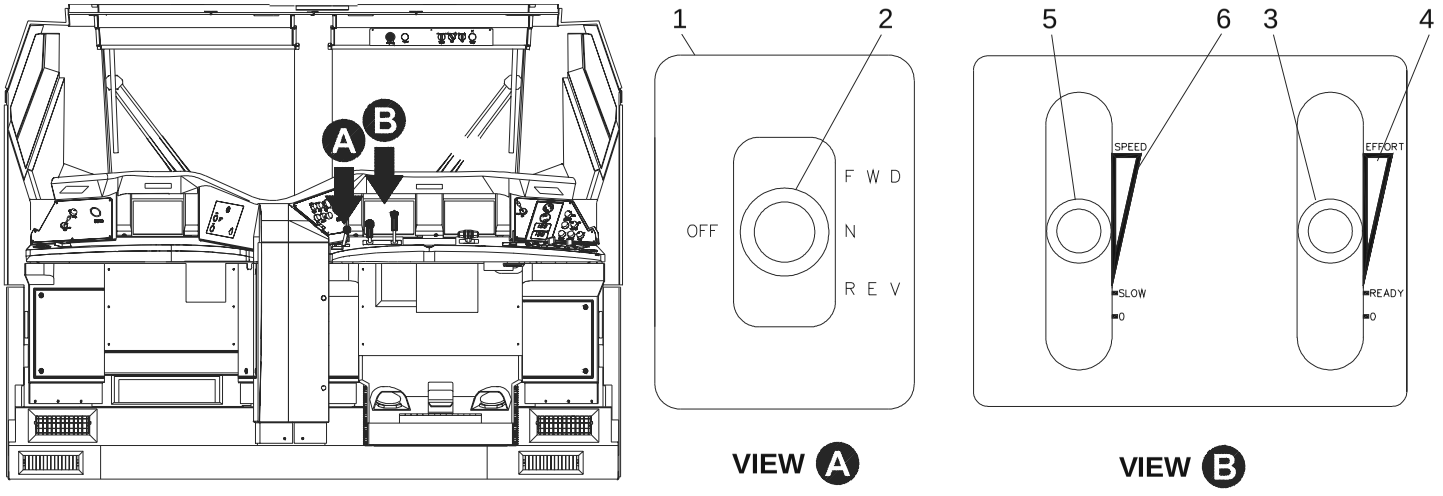
2.1.9.13 Master Controller (Fig. 2-36). The master controller comprises the equipment described in the following subsections.

2.1.9.13.1 Reverser. The master controller reverser is locked when placed in OFF position. When the reverser is unlocked from OFF position by moving it to the right, it goes from inactive to auxiliary power on (N position). The FWD and REV positions are then available.

In order to select a direction of travel, the engineer must verify that the “NO MOTION” indication is shown on the POD and that the parking brakes are applied prior to moving the master controller reverser handle to the “FWD” or "REV" position.

2.1.9.13.2 Throttle Lever. The throttle lever (also called effort lever) provides a traction power range from 0% to + 100% (full effort). The indications provided to the right of the lever are:

(1) 0: No traction effort. The lever has to be cycled back to this position whenever traction power is lost. This position is also used for a running release of a penalty brake application. When the lever is in this position, it locks and it only unlocks if the button on the handle is pressed. When the lever is moved from 0 position, it locks the reverser in the selected direction of travel.



1. Reverser
2. Reverser Handle
3. Throttle Lever (Effort Lever)
4. Effort Range Indicator
5. Cruise Control Lever
6. Speed Range Indicator

AB270026

Figure 2-36
Propulsion Master Controller

NOTE:

The throttle lever must be cycled back to the “0” position to restart traction after a service brake application (after moving the ABCL to the “REL” position).

(2) READY: In this position, traction mode is activated. When the train is in motion while the handle is moved back to this position, the train rolls in coast mode.

NOTE:

When the throttle lever is moved from “0” towards the “EFFORT” position, the traction effort increases progressively.

(3) EFFORT Zone: The amount of effort provided by the propulsion equipment is related to the lever position in the EFFORT zone. The lever is pushed in to achieve more effort, and pulled back to reduce it. The total effort achieved is indicated on the cab display units. In this position, the parking brakes are automatically released. (The current effort is displayed on the MFD1 and MFD2.)

The traction effort is limited by the position of the throttle lever, in traction mode as well as in electric braking mode.

NOTE:

The current effort value is always displayed on the MFD1 and MFD2 displays.

2.1.9.13.3 Cruise Control Lever. The cruise control lever provides a speed range. The range is from 0 to maximum speed. Speed control is imposed by the Main Processing Unit (MPU). The indications provided to the right of the lever are:

(1) 0: No speed set. In this position, the trainset speed is dependent on the amount of effort required.

(2) SLOW: In this position, a direction of travel must be selected, the train can be already running, and the cruise speed mode is activated. The POD displays the “Cruise Slow” indication and the speed value is set at 3 mph.

(3) SPEED Zone: The speed achieved by the trainset is related to the lever position in the SPEED zone. The lever is pushed in to gain more speed, and pulled back to reduce the speed. The speed setting on the primary operating display, in analog and digital formats, increases according to the handle position. A maximum value of 150 mph can be set when the handle is placed fully forward in the SPEED zone.

To allow the propulsion system to regulate the preset speed, the throttle lever is moved forward to the “EFFORT” position.

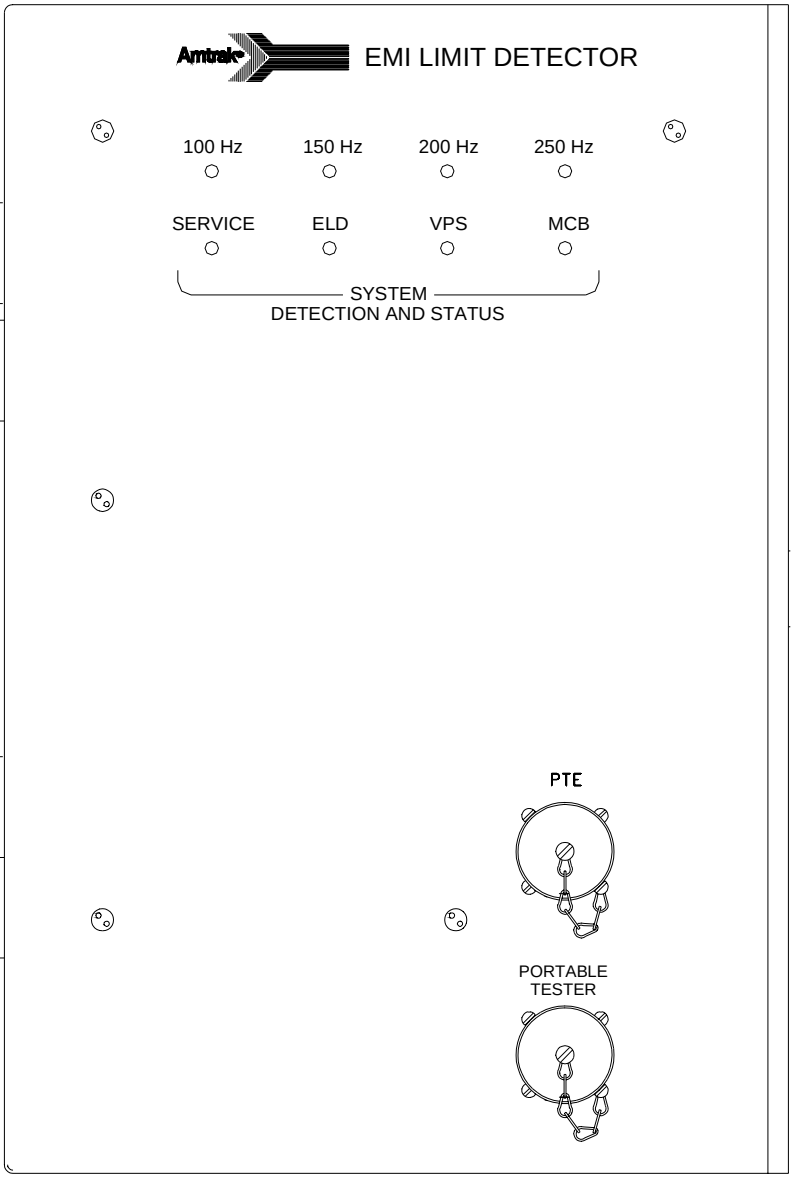
If the cruise speed selected is at or above the current train speed, the traction effort is positive (traction mode).

If the cruise speed selected is below the current train speed, the traction effort is negative (electric braking mode).

NOTE:

Switching between traction mode and electric braking mode is automatic.

2.1.9.14 EMI Limit Detector (Fig. 2-37). When the harmonic current level reaches a threshold, the EMI limit detector opens the main circuit breaker. The following control and indicators are located on the EMI Limit Detector (ELD), mounted on electrical locker No. 2:



AB020003

Figure 2-37
EMI Limit Detector on Electrical Locker No. 2

- 100, 150, 200, 250 Hz status indicators: Red LED ON indicates that harmonic interference is detected. Flashing red LED indicates MCB has been opened but interference is below threshold.
- Red SERVICE LED ON: Communication node not functioning normally.
- Green ELD LED ON: ELD functioning properly. Flashing LED indicates ELD operating properly but lockout condition exists.
- Green VPS LED ON: ELD Vital Power Supply (controls opening of MCB) functioning normally.
- Green MCB LED ON: ELD MCB output is on. This holds MCB closed.
- PTE connector: Provides PTE access to the ELD.
- PORTABLE TESTER connector: Provides test signal generator access to the ELD.

2.1.9.15 Oil Level Detector Bypass Switch. The oil level detector bypass switch, on the propulsion electrical cubicle, is used to bypass a defective main transformer oil level detector. It must be used only when a visual inspection indicates normal oil level. To check the oil level, the central block has to be opened. Do not operate the trainset and refer to maintenance personnel in order to determine if the oil level is low.

CAUTION:

When the oil level detector bypass switch is activated, the main transformer is not protected against a low oil level that could result in damage to the equipment.

2.1.9.16 Head End Power (HEP). The MPUs of both power cars in a trainset start when high voltage is present, and auxiliary inverters become ready. Then, only the trailing power car (cab not active) provides 480 Vac power to the passenger cars by closing its HEP contactor. The leading power car MPU only feeds the local power car loads, and backs up the other power car MPU. When the trailing power car MPU becomes defective, HEP contactors are cycled, and the trainset 480 Vac loads are automatically connected to the leading power car MPU. HEP power is available only if the 480 Vac wayside receptacle access panels are closed at both ends of the trainset and 480 Vac trainlines are connected through all the train consist. If the 480 Vac trainline loop integrity is lost when the train speed higher than 5 mph, the HEP is still supplied.

The HEP configuration remains valid until the opposite cab is activated. When the opposite cab is activated, HEP contactors are cycled, and the HEP configuration changes. This operation lasts a few seconds during which HEP is not available.

The HEP switch on the engineer's overhead switch panel enables the removal and reapplication of the HEP power to passenger cars. In ON position, the switch is operational only in an active cab. The OFF position of the switch is operational all the time.

2.1.9.17 Fire Suppression System. In case of fire, an audio alarm and a visual alarm displayed on the Primary Operating Display (POD) and Multifunction

Display No. 1 (MFD1) warn the engineer, the ONBOARD FAILURE red indicator, on the engineer's overhead switch panel, also turns on.

The fire suppression system is controlled by the two switches listed below:

2.1.9.17.1 FIRE SUPP. ACTIVATION Pushbutton (Fig. 2-9). The sealed FIRE SUPP. ACTIVATION pushbutton, located on the cab rear wall switch panel, can be used to manually activate fire suppression.

2.1.9.17.2 FIRE SUPP. INHIBIT Pushbutton (Fig. 2-9). The FIRE SUPP. INHIBIT pushbutton, located on the cab rear wall switch panel, is used to deactivate the automatic fire suppression.

2.1.9.18 Low Voltage Battery Charger. The HEP (or the 480 V shop supply) feeds the Low Voltage Battery Charger (LVBC), which generates 72 Vdc for the power car battery and low voltage distribution system. There are two battery chargers with only one active at a time. Both are controlled by the PECU.

2.1.9.19 Wheelslip/Slide Control. The propulsion system has its own wheelslip/slide control. A slight slip is corrected by an electric brake effort reduction. The devices used to prevent wheelslip protection operate axle by axle. The propulsion system uses the speed signals of the four axles to define a reference speed and detect slip.

2.1.9.20 Auxiliary Block Key Switch. The auxiliary block key switch is used for safety in power equipment maintenance. It inhibits access to power blocks unless the pantograph and main circuit breaker have been grounded. Refer to Subsection 2.2.8, on page 2-162, "High Voltage Power - Turning Off and On (Fig. 2-97)" for a description on how to perform high voltage equipment grounding.

2.1.9.21 RESET Pushbutton. The RESET pushbutton, on the engineer's left switch panel, is not functional in the power car.

2.1.9.22 Braking Setup. When catenary voltage is lost, traction inverters must be switched to braking mode. In this mode, the available power is used to satisfy braking requests. The power car and trailer car subsystems fed by the auxiliary power are also supplied.

The following are the causes and resulting forms of braking setup:

- A catenary phase change in a phase break, indicated by a beacon (or ACSES), results in braking setup without interruption and without opening the main circuit breaker.
- A catenary voltage change in a neutral area, indicated by a beacon (or ACSES), results in auxiliary power interruption, with braking setup, and with main circuit breaker openings and closings controlled by the PECU.
- A loss of catenary voltage, not indicated by a beacon, results in the main circuit breaker opening and in a change to the best level of braking setup possible.

2.1.10 FRICTION BRAKE EQUIPMENT. The brake system components mounted within the cab console consist of the Automatic Brake Control Lever (ABCL), the ABCL CAN (Controller Area Network) communication module, the emergency brake valves, the BRAKE VALVE C/O switch, the PARKING BRAKE switch, and the SNOW BRAKE pushbutton. In addition, the ALL BRAKE RELEASED TL. bypass switch is mounted on the cab rear wall switch panel.

The air gauges are part of the information provided by the cab display units (MFD1 and MFD2). The following table lists the brake system air pressures indicated on the air gauges under normal operating conditions:

Table 2-3
Air Gauges Indications

GAUGE	ABCL POSITION	INDICATION
Brake Pipe/ Equalizing Reservoir	Release	110 ± 2 psi
	Minimum	102 ± 2 psi
	Suppression	92 ± 2 psi
	Full Service	81 ± 2 psi
	Handle Off/Emergency	0 psi
Brake Cylinder	Release	0 psi
	Minimum	18 ± 4 psi
	Suppression	44 ± 4 psi
	Full Service	52 ± 4 psi (Power Car) 54 ± 4 psi (Passenger Cars)
	Handle Off/Emergency	60 ± 4 psi (Power Car) 64 ± 4 psi (Passenger Cars)
Main Reservoir		125 to 140 psi

The brake system components located inside the power car consist of the brake control unit, brake control computer, independent failure monitor, interior truck brake equipment cutout cocks, conductor's emergency brake valve, and emergency magnet valve cutout cock. In each passenger car the other main components are the detection of nonrotating axles, wheelslide control computer, interior truck brake equipment cutout cocks and conductor's emergency brake valve.

The brake system components located outside each car include the brake control unit (passenger cars only) exterior brake indicators, exterior truck brake equipment cutout cocks, parking brake manual override levers, and pneumatic trainline cutout cocks.

The brake system components located inside each passenger car include the emergency brake valve and truck brake cutout cocks.

2.1.10.1 Automatic Brake Control Lever (Fig. 2-38). The Automatic Brake Control Lever (ABCL), on the engineer's console, provides the interface between the engineer and the brake system. Movement of the ABCL causes the increase or decrease of automatic brake effort.

The ABCL interfaces electronically with the brake control computer, independent failure monitor, PECU, alerter, ACSES, and the ATS/ATC systems, and pneumatically, as an operational backup, directly with the brake pipe equalizing reservoir volume to control the brake pipe pressure.

The ABCL positions are: REL (release), MIN (minimum), SUPP (suppression), FS (full service), HO (handle off), and EM (emergency). Switches signal the handle positions to the various systems: release to the PECU, handle off to the alerter system, suppression to the ACSES, alerter, and the ATC systems.

Movement of the handle to the EM position pilots an E-3 application valve to provide rapid venting of the brake pipe that creates emergency brake cylinder pressure.

When the engineer performs a service brake application by placing the ABCL on a position between "MIN" and "FS", the following happens:

(1) The traction effort is immediately canceled, regardless of the traction mode (manual or cruise).

(2) The propulsion system is switched to electric braking mode.

(3) The traction efforts displayed on the MFD1 and MFD2 are negative.

(4) The electric brake effort is limited by the position of the throttle lever.

(5) If necessary, pneumatic braking is added to the electric brake effort in order to meet the total brake demand defined by the position of the ABCL.

NOTE:

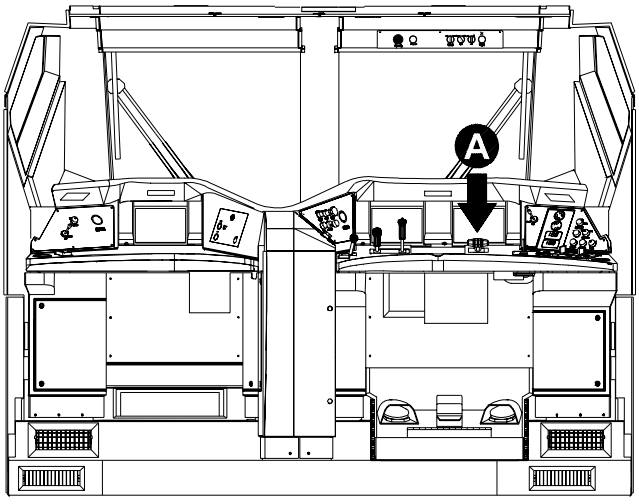
To restart traction after a service brake application, the ABCL must be moved to the "REL" position prior to cycling back the effort lever to the "0" position.

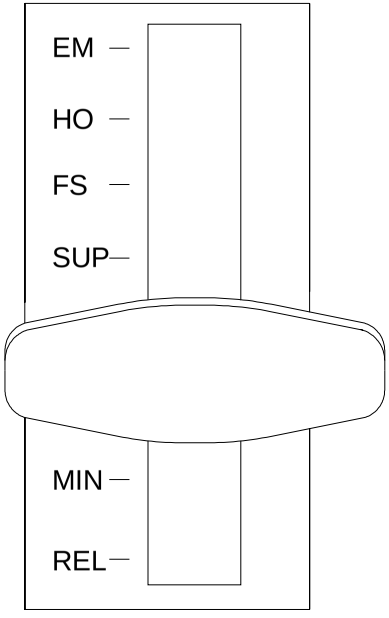
2.1.10.2 ABCL CAN Communication Module. The ABCL CAN (Controller Area Network) communication module is an electronic interface between ABCL operation and the brake control computer/independent failure monitor. This device provides the communication signals for the brake control computer and independent failure monitor in response to the analog signals received from the ABCL.

2.1.10.3 Emergency Brake Valve (Fig. 2-4 and 2-11) . The EMERGENCY BRAKE VALVE pushbutton on the engineer's left switch panel and the assistant's left switch panel, enables the operator to initiate an emergency brake application in an emergency situation.

2.1.10.4 BRAKE VALVE C/O Switch (Fig. 2-3). The BRAKE VALVE C/O switch on the engineer's desk right switch panel is used to cut in BP charging in PASS. (passenger cars) position. BP charging is cut out in OUT position.

2.1.10.5 PARKING BRAKE Switch (Fig. 2-5). The PARKING BRAKE switch on the engineer's right switch panel is used to manually apply or release the parking brakes of the whole trainset.





VIEW A

NOTE:

The ABCL positions are: REL, MIN, SUPP, FS, HO, EM.
The letter "K" between MIN and SUP positions is not a brake lever position.

Figure 2-38
Automatic Brake Control Lever

2.1.10.6 SNOW BRAKE Pushbutton (Fig. 2-5). The SNOW BRAKE pushbutton on the engineer's right switch panel initiates a friction brake application of 6 psi for 60 seconds at each of the trainset disc and tread brake actuators.

NOTE:

During blended brake when electric brake provides all the braking effort (no friction brake applied), the snow brake pressure is completely released through blending magnet valves.

2.1.10.7 ALL BRAKE RELEASED TL. Bypass Switch (Fig. 2-9). The ALL BRAKE RELEASED TL. bypass switch on the cab rear wall switch panel is used to bypass a wrong "All Brakes Released" indication. The switch is to be used when the message "All Brakes Released" is not shown on the cab display units when all the trainset brakes are effectively released.

CAUTION:

If the "All Brake Released" signal is not available, traction is allowed for a small amount of time (10 seconds) only. When the ALL BRAKE RELEASED TL. bypass switch is used to recover traction, make sure that all brakes are released on all cars in the consist prior to train movement.

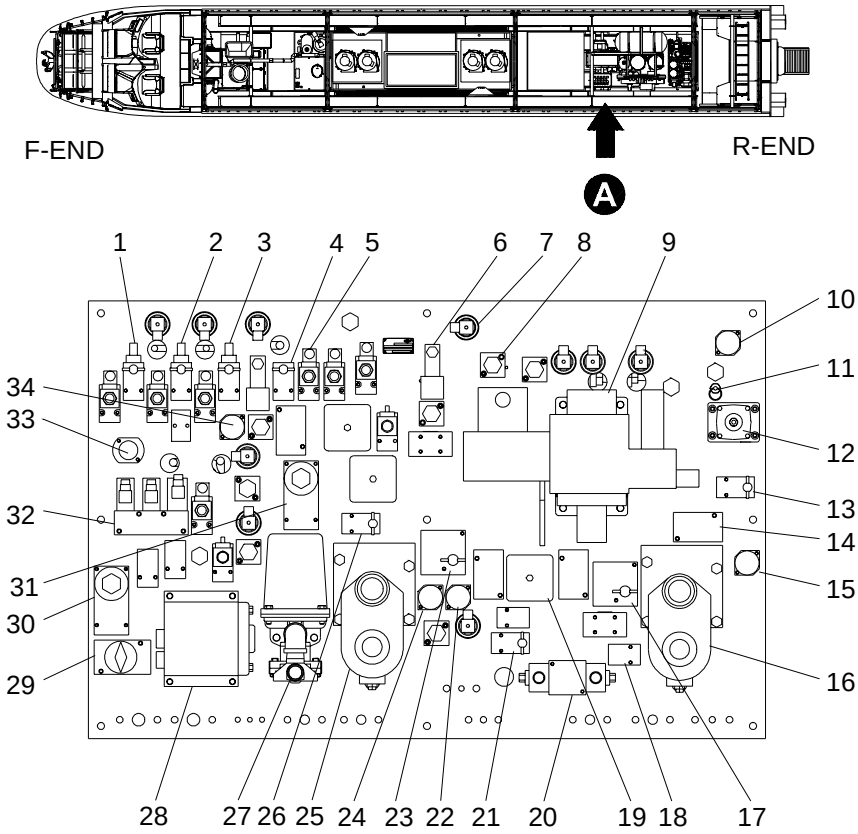
2.1.10.8 Brake Control Unit (Fig. 2-39 and 2-40). The power car Brake Control Unit (BCU) allows both electropneumatic and full pneumatic control of brake pipe pressure. The passenger cars brake control unit handles all the car pneumatic control functions. It contains all the electropneumatic control components, except for the wheelslide control components.

2.1.10.8.1 Power Car BCU (Fig. 2-39). The functions of the power car BCU are:

- Electropneumatic and full pneumatic control of brake pipe pressure
- Penalty application of service brake in response to the ATS/ATC, alerter, and ACSES systems, as well as low main reservoir pressure
- Auxiliary air supply for sanding, bell, horn, and pantograph
- Snow brake function
- Blending with the electric brake
- Brake cylinder pressure in response to brake pipe pressure
- Parking brake function.

The power car brake control unit is equipped with the following cutout cocks:

- Dead engine feature: Cuts out the emergency dead engine feature (the flow of air pressure from the BP to the MR).
- ATC penalty magnet valve: Isolates the ATC penalty brake magnet valve if it fails or if the ATC fails.
- Alerter penalty magnet valve: Isolates the alerter penalty brake magnet valve if it fails or if the alerter fails.
- ACSES penalty magnet valve: Isolates the ACSES penalty brake magnet valve if it fails or if the ACSES fails.



1. ATC Sealed Cutout Cock (Red)
2. Alerter Sealed Cutout Cock (Yellow)
3. ACSES Sealed Cutout Cock (Blue)
4. Towing Feature Cutout Cock
5. Magnet Valve (Typ.)
6. Pressure Transducer (Typ.)
7. Pressure Switch (Typ.)
8. Test Point (Typ.)
9. Brake Control Valve
10. Auxiliary Reservoir Pressure Gauge
11. Auxiliary Systems Safety Valve
12. Auxiliary Systems Pressure Governor
13. Auxiliary Systems Cutout Cock
14. Check Valve (Typ.)
15. Brake Cylinder 2 Gauge
16. Brake Cylinder 2 Relay Valve
17. Brake Supply 2 Cutout Cock
18. Double Check Valve (Typ.)
19. Pressure Reducing Valve (Typ.)
20. Parking Brake Impulse Valve
21. Parking Brake Cutout Cock
22. Main Reservoir Gauge
23. Brake Supply 1 Cutout Cock
24. Brake Cylinder 1 Gauge
25. Brake Cylinder 1 Relay Valve
26. Snow Brake Cutout Cock
27. KM-2 Rapid Vent Valve
28. Brake Pipe Relay Valve
29. Main Reservoir Cutout Cock
30. Main Reservoir Air Filter
31. Towing Feature Air Filter
32. Analog Converter AW4. 1A
33. Low Main Reservoir Pneumatic Valve
34. Brake Pipe Gauge

Figure 2-39
Power Car Pneumatic Brake Control Unit

- MR: Isolates the BCU from the MR supply and vents the BCU of MR air pressure. (It purges air from the manifold and is used for maintenance purposes only.)
- Snow brake: Isolates and vents the snow brake reducing valve and magnet valve from the MR supply.
- Parking brake: Enables the isolation of the parking brake circuit from the brake cylinders in order to vent the parking brake system.
- Auxiliary systems: Enables the isolation of the auxiliary circuit from the MR supply and to vent the auxiliary system.
- Truck equipment: Isolates the brake equipment on a per truck basis.

2.1.10.8.2 Passenger Cars BCU (Fig. 2-40). The functions of the passenger car BCU are:

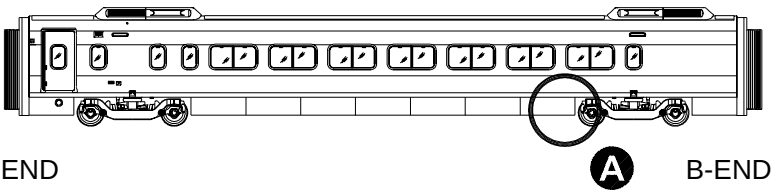
- Snow brake function
- Blending with the electric brake
- Brake cylinder pressure in response to BP pressure
- Parking brake function.

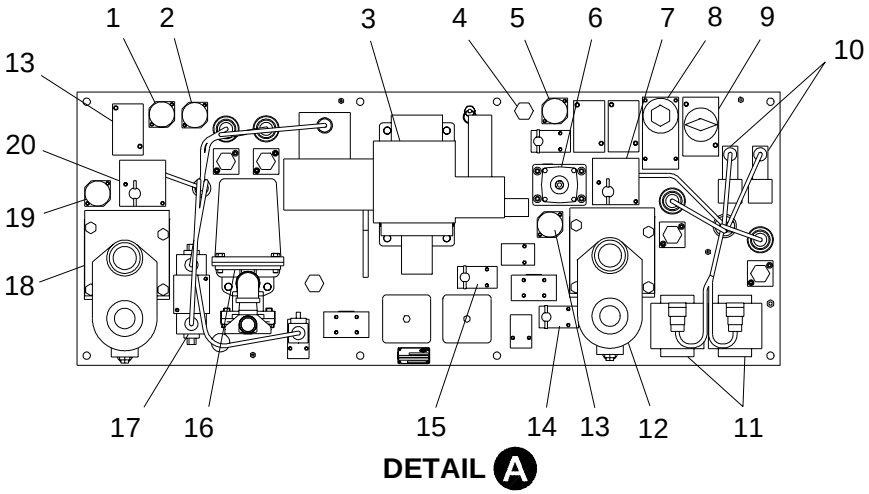
Each passenger car brake control unit is equipped with the following cutout cocks:

- Auxiliary systems: Enables the isolation of the auxiliary circuit from the MR supply and to vent the auxiliary system.
- MR: Isolates the BCU from the MR supply and vents the BCU of MR air pressure.
- Parking brake: Enables the isolation of the parking brake circuit from the brake cylinders in order to vent the parking brake system.
- Snow brake: Isolates and vents the snow brake reducing valve and magnet valve from the MR supply.
- Brake supply cutout cocks No. 1 and No. 2: Isolate the brake equipment on a per truck basis.

2.1.10.9 Brake Control Computer (Fig. 2-41). The Brake Control Computer (BCC), located on the electrical locker of the power car (combined with detection of nonrotating axles), is the main control element of the brake system. The BCC is responsible for the following major functions within the brake system:

- Control of brake pipe
- Blending calculations
- Electric brake control
- BP pressure calculation from brake demand
- EP assist control
- Calculation of percentage of friction brake operative
- Diagnostics/maintenance event annunciation.





1. Main Reservoir Pressure Gauge
2. Brake Pipe Pressure Gauge
3. Valve KE3.10
4. Auxiliary System Cutout Cock
5. Auxiliary Pressure Gauge
6. Governor (80 psi)
7. Brake Supply Cutout Cock No. 2
8. Air Filter
9. Main Reservoir Cutout Cock
10. Pressure Transducer
11. Anti-Skid Valve
12. Brake Cylinder 2 Relay Valve
13. Brake Cylinder 2 Pressure Gauge
14. Parking Brake Cutout Cock
15. Snow Brake Cutout Cock
16. KM-2 Vent Valve
17. Parking Brake Impulse Valve
18. Brake Cylinder 1 Relay Valve
19. Brake Cylinder 1 Pressure Gauge
20. Brake Supply Cutout Cock No. 1

B100004

Figure 2-40
Passenger Car Pneumatic Brake Control Unit - Typical

2.1.10.10 Detection of Nonrotating Axles (Fig. 2-41 and 2-42). The Detection of Nonrotating Axles (DNRA) is a secondary control element of the brake system. The DNRA is responsible for the following major functions within the brake system:

- Detection and annunciation of locked axles
- Release of locked axles by complete venting of brake cylinder pressure
- Diagnostics/maintenance event annunciation.

2.1.10.11 Wheelslide Control Computer (Fig. 2-41 and 2-42). The Wheelslide Control Computer (WSCC) is responsible for the following major functions within the brake system:

- Friction brake wheelslide/slip control
- Monitoring of truck equipment for cutout
- Electric brake reduction
- Sanding control
- Manual cutout of brakes through the dump valves
- Detection and annunciation of locked axles
- Diagnostics/maintenance event annunciation.

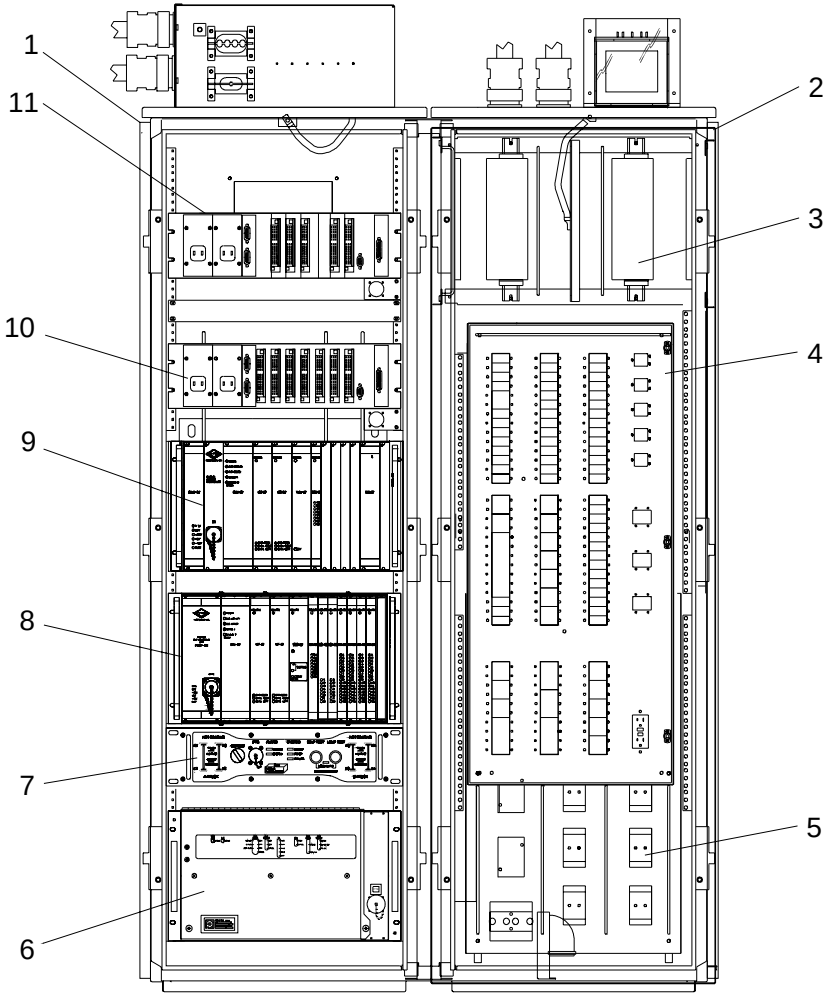
The WSCC maximizes the wheel to rail adhesion level through reduction of brake cylinder pressure, or reduction of electric brake effort.

Control of the electric brake is accomplished through the PECU until the level of slip is too great, when the WSCC takes over the reduction of electric brake.

2.1.10.12 Independent Failure Monitoring System (Fig. 2-41). The Independent Failure Monitoring System (IFM) is located on the power car electrical locker No. 1 (combined with WSCC). It is an independent system by which the total requested brake demand from the ABCL is compared with the pressure of the brake pipe and propulsion computer. The calculated friction brake effort determined from BP reduction added to the propulsion computer signal should equal the total brake demand. Any discrepancy is reported over the data management system/car internal network, and an alarm is generated to the cab display unit.

2.1.10.13 Conductor's Brake Valve (Fig. 2-98 and 2-99). Each conductor's brake valve in the trainset initiates an emergency brake application when the valve handle is pulled down.

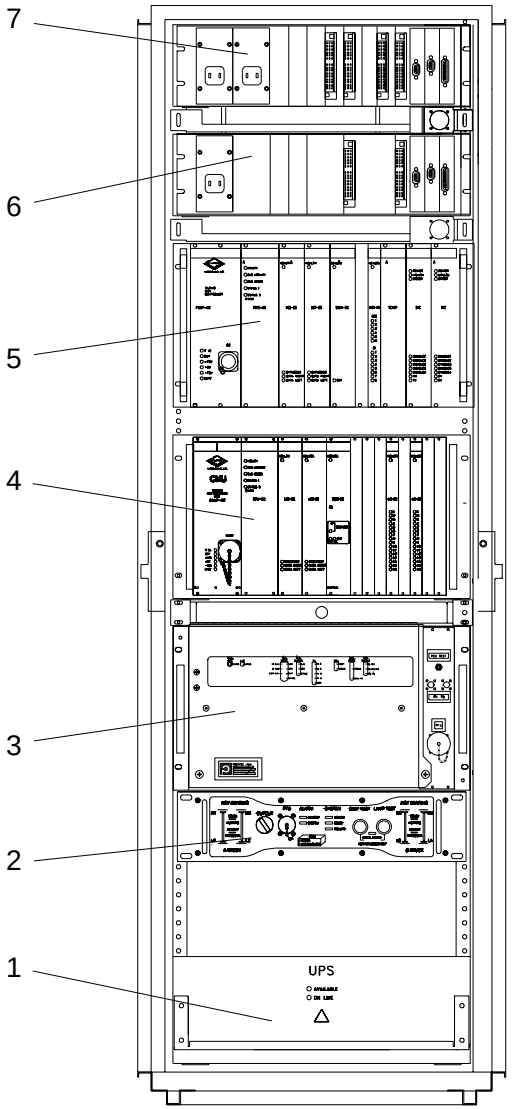
2.1.10.14 Exterior Truck Brake Cutout Cocks. The exterior truck brake cutout cocks are mounted in-line with the brake cylinder supply line to a particular truck. Electrical contacts are provided on the cock to provide a warning signal to the engineer that the truck brake equipment has been isolated.



1. Electrical Locker No. 1
2. Electrical Locker No. 3
3. Terminal Block
4. Circuit Breaker Panel (Page 2-26)
5. Relay Panel
6. Power Car Communication Control Unit (PCCU, Page 2-53)
7. Integrated Truck Surveillance Unit (ITSU, Page 2-11)
8. Car Monitoring (CMU, Page 2-89)
9. Tilting Master Controller (TMC, Page 2-16)
10. Brake Control Computer (BCC, Page 2-75) with Detection of Nonrotating Axle (DNRA, Page 2-77)
11. Independent Failure Monitor (IFM, Page 2-77) with Wheelslide Control Computer (WSCC, Page 2-77)

AB100002

Figure 2-41
Power Car Electrical Locker No. 1 and No. 3



AB100003

1. Uninterruptable Power Supply (UPS, Page 1-55)
2. Integrated Truck Surveillance Unit (ITSU, Page 2-11)
3. Communication Control Unit (CCU, Page 2-53)
4. Car Monitoring Unit (CMU, Page 2-89)
5. Tilting Car Controller (TCC, Page 2-17)
6. Detection of Nonrotating Axle (DNRA, Page 2-77)
7. Wheelslide Control Computer (WSCC, Page 2-77)

Figure 2-42
Passenger Car Electrical Locker Computer Controlled Equipment - Typical

2.1.10.15 Brake Indicators. The pneumatic brake indicators provide a positive indication, per axle, of the status of brake cylinders and parking brake.

In the extended position, they indicate that the brakes are applied as follows:

The red indicator, labelled "BC Indicator", indicates that the brake cylinders are charged to signal that the brakes are applied on that truck.

The gold indicator, labelled "PB Indicator", indicates that the parking brakes are applied on that truck.

WARNING:

A FALSE PARKING BRAKE APPLY INDICATION CAN OCCUR IF THE PARKING BRAKE IS APPLIED (USING THE PARKING BRAKE SWITCH ON THE ENGINEER'S RIGHT SWITCH PANEL OR THE PARKING BRAKE CUTOUT COCK ON THE BRAKE CONTROL UNIT) AND THE TRUCK MOUNTED PARKING BRAKE MANUAL OVERRIDE LEVER IS PULLED.

2.1.10.16 Parking Brake Manual Override Levers. A manually operated lever allows manual release of the parking brake on each axle, for a truck, from either side of the truck.

2.1.11 CAB SIGNAL AND AUTOMATIC TRAIN CONTROL SYSTEMS. The cab signal and automatic train control systems controls and indicators are detailed in the following subsections.

NOTE:

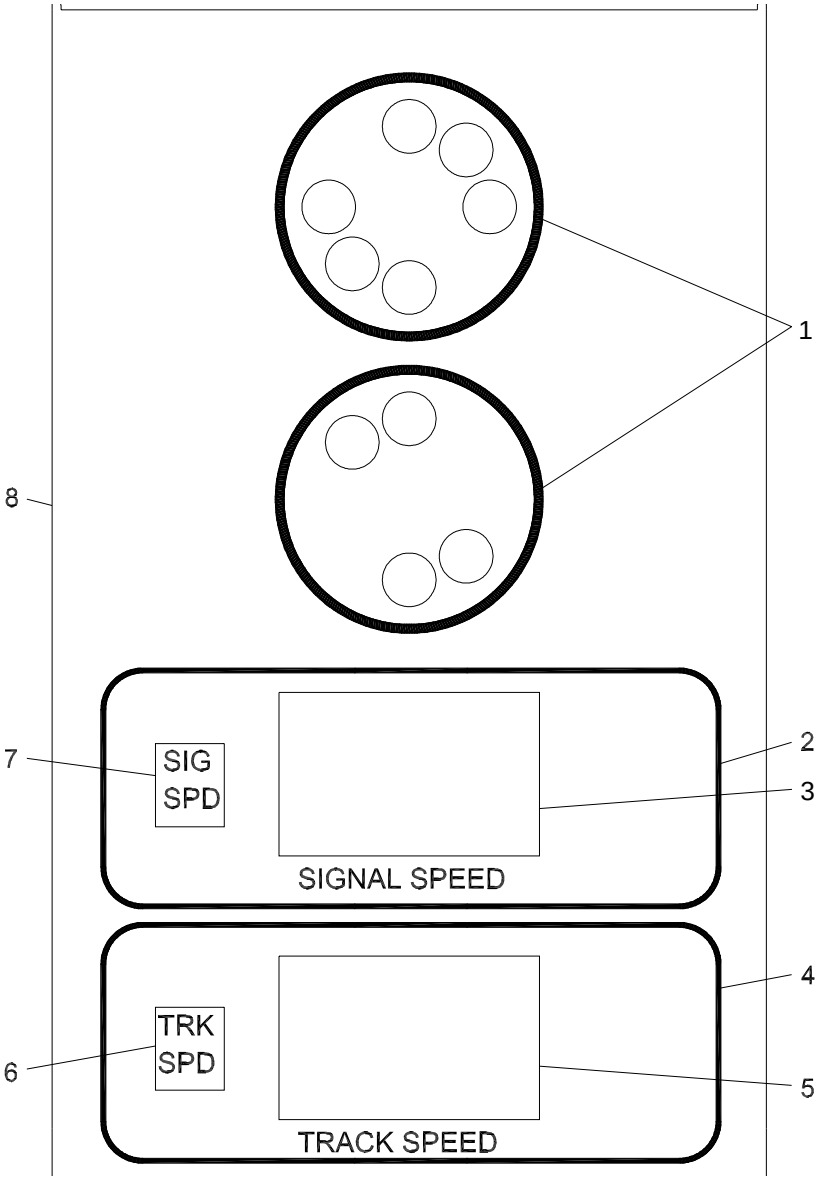
Operating rules on the subject prevail.

2.1.11.1 Aspect Display Unit (Fig. 2-43 and 2-44). An Aspect Display Unit (ADU) is mounted on the engineer's right switch panel. It contains a color position display, used to display the current wayside signals. The ADU also incorporates two orange digital displays. The top display, identified SIGNAL SPEED, is used in conjunction with the aspects to display the current wayside aspects. The bottom display, identified TRACK SPEED, is used to display track speeds from the ACSES system. (See figure 2-44 "Aspect Display Unit Indications" for a description of the nine aspects, with their speed limitations, displayed on the ADU.)

When the cab signal-authorized speed is equal to or lower than the ACSES authorized speed, the cab signal-authorized speed is indicated by the SIG SPD indicator to the left of the cab signal-authorized speed. When the ACSES-authorized speed is lower than the cab signal-authorized speed, the ACSES-authorized speed is indicated by the TRK SPD indicator to the left of the ACSES-authorized speed.

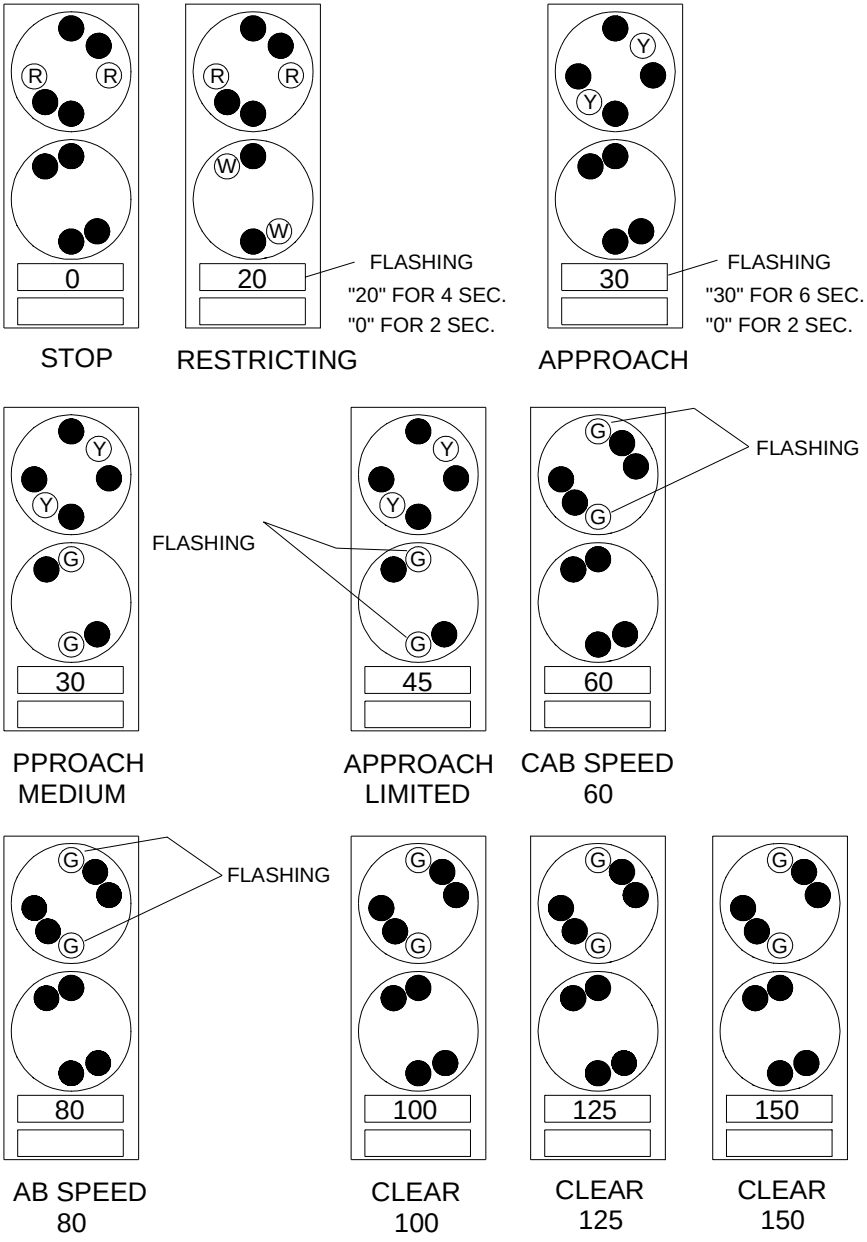
If the ACSES speed is received as unknown or invalid, the ADU displays three horizontal bars as the ACSES speed, and the maximum ACSES authorized speed is 125 mph.

The ADU houses a buzzer for each system: Steady tone for ATS/ATC, pulsed tone for ACSES.



1. Color Position Display
2. Top Display for Wayside Aspects
3. Signal Speed Display (Cab Signal Authorized Speed)
4. Bottom Display for ACSES Track Speed
5. Track Speed Display (ACSES Authorized Speed)
6. TRK SPD Indicator (ACSES Speed Most Restrictive)
7. SIG SPD Indicator (Cab Signal Speed Most Restrictive)

Figure 2-43
Aspect Display Unit



AB020005

Figure 2-44
Aspect Display Unit Indications

When the CAB TERRITORY switch on the cab rear wall switch panel is in OUT position, the ADU darkens the ATS/ATC aspects and displays a “79” in the signal speed display. The 79 mph limit is enforced by the ATS/ATC system.

When the ADU is not in the active cab, no buzzer sounds, but the displays remain active.

Additional nonvital indications, displayed on POD, MFD1, and MFD2, are shown in Table 2-4.

Table 2-4
Cab Signal and Automatic Train Control Cab Display Unit Indications

INDICATION	DISPLAY	FUNCTIONS
NO-MOTION (YELLOW)	POD	On when speed sensing system detects zero velocity.
OVERSPEED (RED)	POD	On steady in overspeed flashing in penalty.
NON-CAB TERRITORY (YELLOW)	POD	On steady when CAB TERRITORY switch is in OUT position.
ATS/ATC CUT-OUT (WHITE)	MFD1 MFD2	On steady when automatic train supervision switch (ATSCO) is in CUTOUT position.
SPEED SYSTEM CUTOUT (WHITE)	MFD1 MFD2	On steady when speed system switch (SSCO) is in CUTOUT position.
APPLICATION (WHITE)	POD	On steady when there is confirmation of loss of traction power.
SUPPRESSION (YELLOW)	POD	Flashes at deceleration between 0.9 to 1.2 mphps. On steady when the ATC system is being forestalled by the permanent suppression input or a brake rate greater or equal to 1.2 mphps.

2.1.11.2 CAB TERRITORY Switch (Fig. 2-9). The CAB TERRITORY switch on the cab rear wall switch panel, must be maintained in the IN position whenever the trainset is operating in cab signal territory. When the trainset is in noncoded territory and this switch is moved to the OUT position, the overspeed detection point changes from 20 mph to 79 mph. Transition to noncoded operation can only be accomplished when no cab signal code is being received and the train speed is less than 20 mph.

2.1.11.3 Cab Signal Acknowledgment Switches (Fig. 1-11 and 2-4). Two separate acknowledgment are provided. The first is from the ACKNOWLEDGE switch on the engineer’s desk right switch panel. The second is from the acknowledge footswitch mounted between the horn footswitch and the radio footswitch.

2.1.11.4 PASS STOP ACSES Pushbutton. The PASS STOP ACSES pushbutton, on the cab rear wall switch panel, is used to release a positive stop brake application when the train comes to a complete stop short of a home signal. Use of the PASS STOP pushbutton changes the aspect back to RESTRICTING, and allows the train to move at restrictive speed.

WARNING:

OPERATION OF THE PASS STOP ACSES PUSHBUTTON MUST BE IN ACCORDANCE WITH RAILROAD OPERATING RULES.

2.1.11.5 NO-MOTION BYPASS Switch (Fig. 2-24). The engineer can bypass the speed sensing system by pressing on the NO-MOTION BYPASS switch on the engineer's right switch panel in case of failure.

When the switch is used to bypass a defective speed sensing system, the engineer can:

(1) Charge the brake pipe after an emergency brake.

(2) Reset, or close, the MCB after an emergency brake.

(3) Apply the parking brake.

(4) Extend the mirrors momentarily, if the MIRRORS (PUSH TO RETRACT) switch is held in OUT position.

2.1.11.6 ACSES Cutout Switch. With the ACSES cutout switch in cutout position, the ADU darkens the ACSES speed limit information and deactivates the ACSES sonalert. The ATS/ATC system enforces 125 mph as the maximum speed. The switch is located on the ACSES equipment rack.

2.1.11.7 ATS and Speed Sensing Cutout Switches (Fig. 2-99). Two sealed cutout switches, labeled ATSCO and SSCO, are mounted on the ATS/ATC equipment cabinet in the equipment room.

The Automatic Train Supervision Cutout switch (ATSCO) bypasses the ATS system. It is to be used when an ATS or ATC failure cannot be cleared. With the ATSCO in cutout position, the ADU darkens the ATS/ATC aspects and the signal speed display, and deactivates the ATS/ATC sonalert. The ACSES display shows 79 as maximum speed limit information.

The Speed Sensing Cutout switch (SSCO) cuts out the speed sensing system, by shutting down the speed sensing CPU (all related functions are lost, including the speed displayed on the POD). It allows ATS operation with no overspeed enforcement.

NOTE:

When the speed sensing has been cut out, the NO-MOTION BYPASS switch is used to intentionally bypass the no-motion signal provided by the speed sensing system.

2.1.11.8 Alerter/Recorder Equipment (Fig. 2-45). The alerter/recorder system includes the following items: Alerter/Recorder Control Unit (ARU), alerter alarm unit, cab microphone.

The alerter/recorder control unit consists of two different systems: alerter system on the right side of the unit, and recorder system on the left side. The unit, located on electrical locker No. 2 in the equipment room, performs all major control and recording tasks. The ARU front face plate is equipped with the control and indicators described below:

The download module provides high speed data extraction to a memory card (PCMCIA) that can be easily downloaded to computer for future analysis. To download the recorded information on a memory card, press on the DWL button once a PCMCIA card has been inserted in the card slot. The LEDs on the PCMCIA card provide the following information:

- DWL.: Yellow, lit when the recorder information is being downloaded to the memory card.
- SYS. FLT.: Red, on when the ARU is defective.
- PCM. FLT.: Red, on when the recorder is not able to download information on the memory card due to a card failure.

The two-position (NORMAL, BYPASS) sealed cutout switch can be used to clear a penalty brake application due to a system failure. The switch cuts out the alerter magnet valve circuitry only.

NOTE:

In order to prevent further problems, perform a pneumatic cutout (with the alerter penalty magnet valve cutout cock) whenever the alerter cutout switch is used.

The two PTE connectors are used to connect the portable test equipment. One connector (PTE2, AMTRAK connector) is compatible with the existing download system, the other is (PTE1) compatible with the newer PTE standard.

The CPU card, is equipped with the following LEDs:

- CIN ACTIVITY: Green, blinking when the ARU is communicating with the car internal network
- CPU FAILURE: Red, on when the central processing unit has failed.
- CIN SERVICE: Yellow, on or flashing when the network interface requires servicing.

The other indicators on the ARU, in the power supply card consist of LEDs that provide information on the different voltages supplied to the unit, and on the output from the penalty magnet valve. In normal operating conditions they should be on.

The cab microphone is located between the engineer station and the assistant station in each cab. It allows the system to transform background audio in the cab into analog signals transmitted to the recorder.

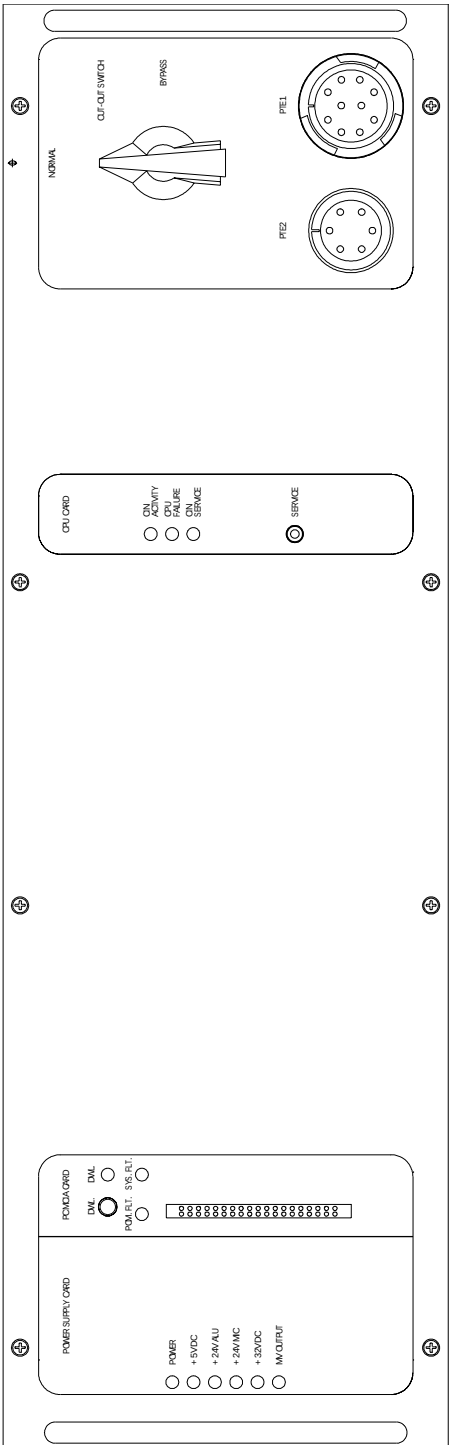


Figure 2-45
Alerter/Recorder Control Unit

2.1.11.9 Alerter Operation and Timing. The alerter system monitors operator movements through various console equipment over a period of 25 seconds. This time base is fixed and does not vary with the train speed.

The ARU is connected to an alerter alarm unit in the cab. The alarm unit generates a progressive audible alarm tone for the alerter function. If no activity has been detected, the audible and visual alarms in POD start beeping/blinking over an additional 15-second period. The audible alarm intensity is progressive and the beeping is done at a fixed frequency. The visual alarm on POD increases in size. If no reset is actuated, a penalty brake with loss of traction power is initiated, while the audible alarm stays steady on for 5 more seconds and then shuts off. When the system initiates a penalty, a full service brake application with loss of traction power occurs. To reset the penalty condition, the brake handle has to be placed into the suppression position and it is not necessary to stop the train.

The resets available to the engineer are:

- Acknowledge footswitch activation
- Acknowledge whisker switch activation
- Horn button utilization
- Horn footswitch utilization
- Bell button utilization
- Automatic brake control lever operation
- Throttle lever operation.

NOTE:

If the ATC is cutout, the alerter cannot be acknowledged by the acknowledge footswitch and acknowledge whisker switch. One of the other reset functions must then be used.

2.1.12 TRAIN MONITORING AND DATA MANAGEMENT SYSTEMS. The following subsections describe the train monitoring and data management systems equipment.

The power car cab equipment consists of display units, a thermal printer, and a CDU SELECTOR switch. The equipment room contains the car monitoring unit and the car internal network router.

The cafe car also has the following equipment installed in the crew office: Multifunction Display Cafe (MFDB), Workstation (WS)/Data Management System (DMS), key card reader, and data radios. (Refer to Subsection 2.1.9.1, on page 2-58, "Key Card Reader" for a description of how it is used to get access to the multifunction displays.)

2.1.12.1 CDU Selector Switch. The CDU Selector Switch, on the cab rear wall switch panel, has three positions: BOTH, POD and MFD1. BOTH is the normal operating position.

In degraded mode, when one a screen has failed, the other can be manually selected in order to display both screens indications at the same time.

2.1.12.2 Thermal Printers. The power car cab thermal printer is used to print train orders. In the cafe car, the crew office printer is used to print train orders and passenger manifests.

2.1.12.3 Car Monitoring Unit (Fig. 2-46). The Car Monitoring Unit (CMU) start-up sequence is initiated by the availability of the main 72 Vdc power source. On start-up, the CMU performs self-tests, detects hardware configuration, and reads the car number. The LEDs located at the top of each card of the CMU indicate the status of the card: if the LED is ON, the card is defective. The BYPASSED LED at the bottom of the card indicates if this card is in fault and has been bypassed.

2.1.12.4 Entry Control. All the Cab Display Units (CDUs) processors and network controllers are always on-line and running. The CDU operating pages are protected through the use of the card reader and master controller.

Control is provided to protect against unauthorized entry and data manipulation, increase LCD backlight life expectancy, decrease global power requirements and decrease network traffic.

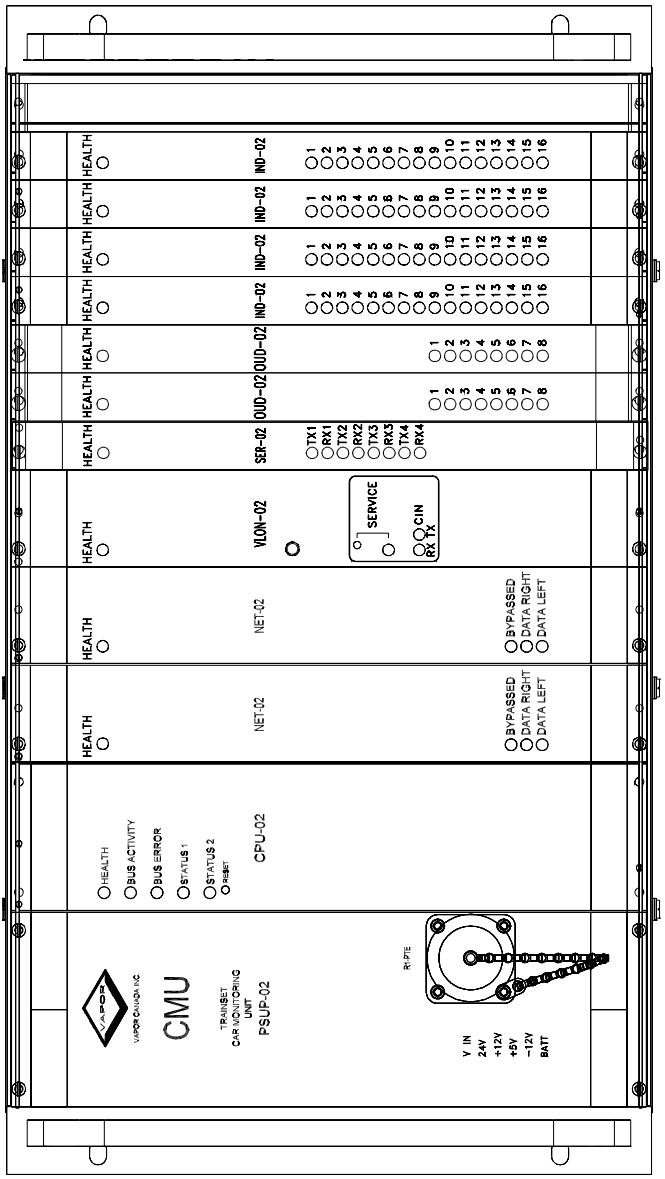
2.1.12.5 Cab Display Units and MFDB (Fig. 2-47 to 2-81). The CDUs and the MFDB are the primary interface to the train and its subsystems for the train crew and maintenance personnel.

Refer to Table 2-1, on page 2-58, "Leading Cab Access Levels" and to Table 2-2, on page 2-59, "Trailing Cab Access Levels", for the authorization level required for each CDU. The MFDB access levels are detailed in the Table 2-8, on page 2-114, "MFDB Access Levels".

Two screens are located on the engineer's console: Primary Operating Display (POD), and Multifunction Display No. 1 (MFD1). Multifunction Display No. 2 (MFD2) is located in the assistant's console. Multifunction Display Cafe (MFDB) is located in the crew office of the cafe car.

- POD displays speed, speed limits, time, cruise control setting, alarms, and the reasons for the speed limitation.
- MFD1 displays pneumatic pressures, traction effort, abnormal subsystem states, and alarms. It provides access to the train operations and alarm handling functions. It is also used to initiate predeparture tests and speed check.
- MFD2 displays subsystem status, maintenance events, and manual fault entry. Inserting an ID card and a valid PIN number in the key card reader, results in the main operations page appearing on this screen. This screen can be activated in nonactive cabs.
- MFDB is functionally identical to the MFD2, with the exception that the pneumatic pressures and the effort gauge are not displayed on the main operations page.

2.1.12.6 Primary Operating Display (Fig. 2-47 and 2-48). The Primary Operating Display (POD) is an intelligent active speedometer that provides all necessary speed related information in analog and digital readout formats. It displays the information listed in the following subsections.



AB120005

Figure 2-46
Car Monitoring Unit - Typical

2.1.12.6.1 Speed Related Information. The speed related information shown on the POD is as follows:

- Actual analog train speed
- Actual digital train speed
- Cruise set indication
- Analog cruise speed
- Digital cruise speed
- Maximum authorized speed.

2.1.12.6.2 Indications. The POD also provides the following indications:

- Alerter
- Overspeed warning
- Brake suppression
- Penalty brake application
- Time of day
- Door open inhibit
- Fire detected
- Hot journal
- Truck hunting
- No cab signal
- No motion bypass or no motion
- Tilting off
- Car not centered.

2.1.12.6.3 Alertness Indication. POD integrates the crew alertness indication. When a command is received from the alerter, POD displays a flashing warning simultaneously with the alerter audible tone. Following the alerter warning sequence, the flashing warning changes from a small indicator to a large one, 5 seconds before the penalty brake application. Once the alerter signal is acknowledged by the engineer, the alerter command is discontinued and the display returns to normal.

2.1.12.7 Multifunction Display No. 1 (Fig. 2-49 to 2-52). Multifunction Display No. 1 (MFD1) is dedicated to train operations. It displays operational values and statuses. The data of the main operation page cannot be removed from view, although some function keys can introduce pop-up windows.

2.1.12.7.1 Main Operation Page. The main operation page is used by the engineer to view critical information at a glance. The page is split into three sections.

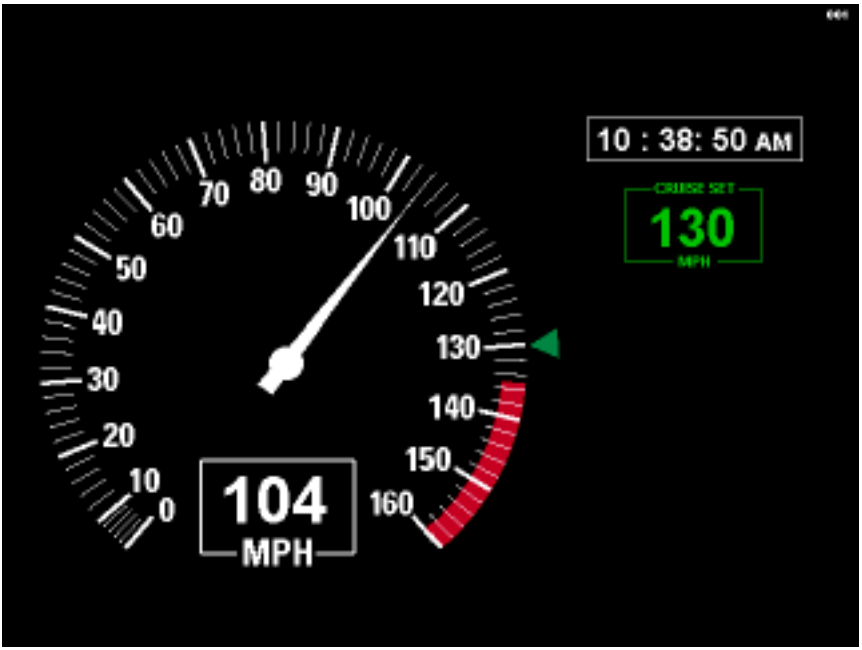


Figure 2-47
Primary Operating Display in Normal Mode

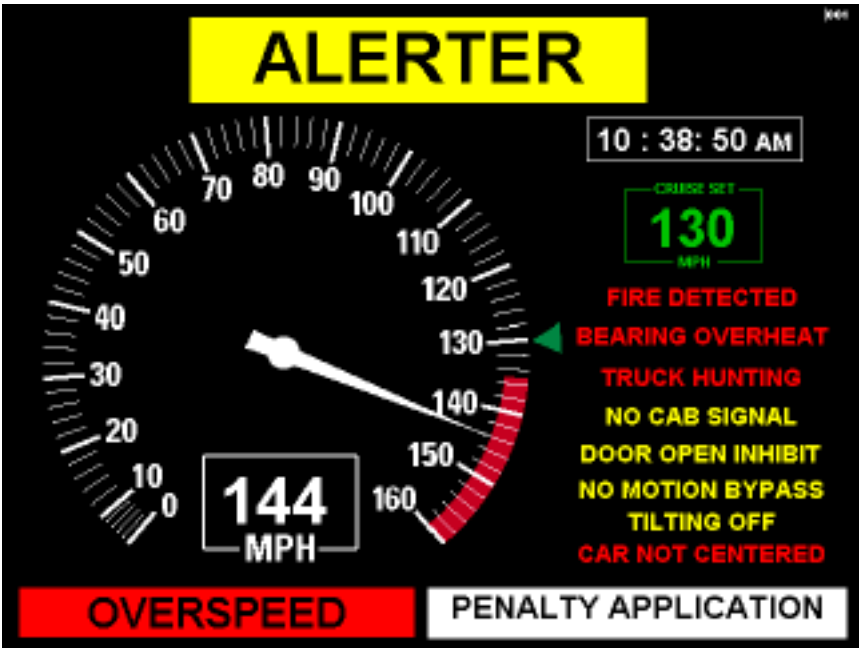


Figure 2-48
Primary Operating Display with Indications Displayed

The ALARMS section provides a scrolling list of existing system alarms, sorted by criticality. The list shows the ten most critical alarms. As an alarm cause is cleared, the list scrolls to the next most critical item. In the event of more than ten alarms, a Next Page button becomes available.

The train operational values section provides the actual values in analog readouts of various operational parameters. The number of parameters to be displayed is a compromise between obtaining critical data and keeping the page uncluttered to enable viewing the information at a glance. MFD1 displayed data is limited to the following information:

- Brake pipe and brake cylinder pressure (same analog gauge)
- Main reservoir and equalization reservoir pressure (same analog gauge)
- Electrical traction/braking effort

The TRAIN STATUS section provides the following train status information:

- Friction Brakes: All released, all applied
- Parking Brake: Released, applied
- Pantographs: Up/down (depending on actual state of each pantograph)
- Doors: Closed and locked, open
- Wheelslip: Slip/spin (yellow), no slip/spin (gray)
- Authorization level.

2.1.12.7.2 Alarms. The following tables lists all the alarms that can be displayed on MFD1 and MFD2. All levels of alarms are listed. Refer to Subsection 3.2, on page 3-1, "Alarms" for a detailed explanation of the alarm levels. Refer to the troubleshooting tables sections in chapter 3 for more details on the actions to perform in case of alarm.

NOTE:

For some alarms, the car number is indicated after the alarm text.

Table 2-5
Level 1 Alarms

ALARM TEXT	ALARM TEXT
ACSES FAULT	ALERTER FAULT
ATS/ATC FAULT	BATTERY OVERTEMP
BRAKE CONTROL FAULT	CAR NOT CENTERED
CONDUCTOR VALVE APPL	EMERG DOOR RELEASED
EMI LIMIT EXCEEDED	FIRE DETECTED
HOT JOURNAL (L1 to L4, R1 to R4)	LOCKED AXLE (#1 to #4)
LOW TRANSFORMER OIL	SPEED SENSING FAULT
TRACTION STILL APPLIED	UNKNOWN SPEED RESTRICTION

Table 2-6
Level 2 Alarms

ALARM TEXT	ALARM TEXT
BATTERY CB OPEN	BATTERY CHARGERS FLT
BRG SENSOR FAULT (L1 to L4, R1 to R4)	CANNOT ANNOUNCE > 15% LOSS
CAT VOLTAGE BELOW 8.4KV	CAT VOLTAGE BELOW 8.7KV
CAT VOLTAGE BELOW 17.5KV	ELD FAULT/LOCKED OUT
ELECT BRAKE LOSS 50%	ELECT BRAKE LOSS 100%
EVENT RECORDER FAULT	HEP FAULT
INCOMING TRAIN ORDER	LOAD SHED LEVEL 2 FLT
LOSS OF > 15% FRICTION BRAKE	MAIN CB LOCKED OUT
NO WHEEL SLIP PROTECT	PANTO F BROKEN
PANTO R BROKEN	PANTO F TOO HIGH
PANTO R TOO HIGH	TILTING FAULT
TRACTION LOSS 50%	TRACTION LOSS 100%
TRUCK HUNT FAULT (A or B)	TRUCK HUNT FAULT (F or R)
TRUCK HUNTING (A or B)	TRUCK HUNTING (F or R)
TRUCK SURVEIL FAULT	

Table 2-7
Level 3 Alarms

ALARM TEXT	ALARM TEXT
ACSES C/O	ACSES DATA NOT AVAILABLE
ACSES MAGN VALVE C/O	AIR BAG DEFLATED (A or B)
ALARMS NOT AVAILABLE	ALERTER C/O
ALERTER MAGN VALVE C/O	ALL BRK RELEASED C/O
ATS C/O	ATS/ATC DATA NOT AVAILABLE
ATS/ATC MAGN VALVE C/O	BRAKE OFF SWITCH ACT
BRAKE SUP C/O (#1 or #2)	BRG SENSOR BYPASS (L1 to L4, R1 to R4)
CARD READER C/O	CAT VOLTAGE BELOW 10.8KV
CAT VOLTAGE BELOW 11.2KV	CAT VOLTAGE BELOW 22.5KV

Table 2-7
Level 3 Alarms (Continued)

ALARM TEXT	ALARM TEXT
DOORS C & L BYPASS	DOORS OPEN INHIBIT
EMERG C/O COCK	FIRE OUTPUTS C/O
FIRE SUPP CYL BYPASS	FIRE SUPP INHIBITED
HEP OUTPUT OFF	HOT JOURNAL WARNING (L1 to L4, R1 to R4)
MAIN 480 VAC CB OPEN	MAIN CB OPEN
NO 480V T/L CONTINUITY	NO-MOTION BYPASS
ON BOARD RESTRICTION C/O	PANTO PB ACTIVATED
PNEUMATIC BACKUP ACTIVE	SANDING
SNOW BRAKE APPLIED	SPEED SENSING C/O
TILTING CENTERED C/O	TILTING SIMULATION MODE
TRANSFORMER OIL C/O	TRUCK EQ C/O #1
TRUCK EQ C/O #2	TRUCK HUNT BYPASS (A or B)
TRUCK HUNT BYPASS (F or R)	TRUCK SURVEIL C/O

2.1.12.7.3 Alarm Help Procedures Page. The alarm help procedures window provides the information for taking action following train and subsystem alarms. This window is accessed using the function keys on the main operations page. The alarm handling window repeats the reported alarms of the operations page. It displays the online help procedure for level 1 and level 2 alarms. The engineer can scroll through the alarm list using the function keys.

2.1.12.7.4 Train Operations Page. The train functions facilitate the operation of the train. They present specific information and controls on various train operations. They are accessed using the function keys, as a pop-up window on the main operations page. The initial page shows the dates and time of the last predeparture tests.

The train operations page presents step by step procedures for the following predeparture tests: Alerter Test, Brake Test, ATC Test, ITSU Test and ACSES Test. The results can be printed out in order to be signed by maintenance personnel.

2.1.12.7.5 Incoming Train Order. When a train order is sent from the wayside operations centers to the train, it is received by the DMS. Upon reception, an incoming train order alarm is generated, requiring acknowledgment by the engineer on MFD1. The train order then prints out in the cab.

Confirmation of the train order printout is required by the engineer (in case of a paper jam). A reprint command is also available. No additional incoming train order can be received until printout has been confirmed.

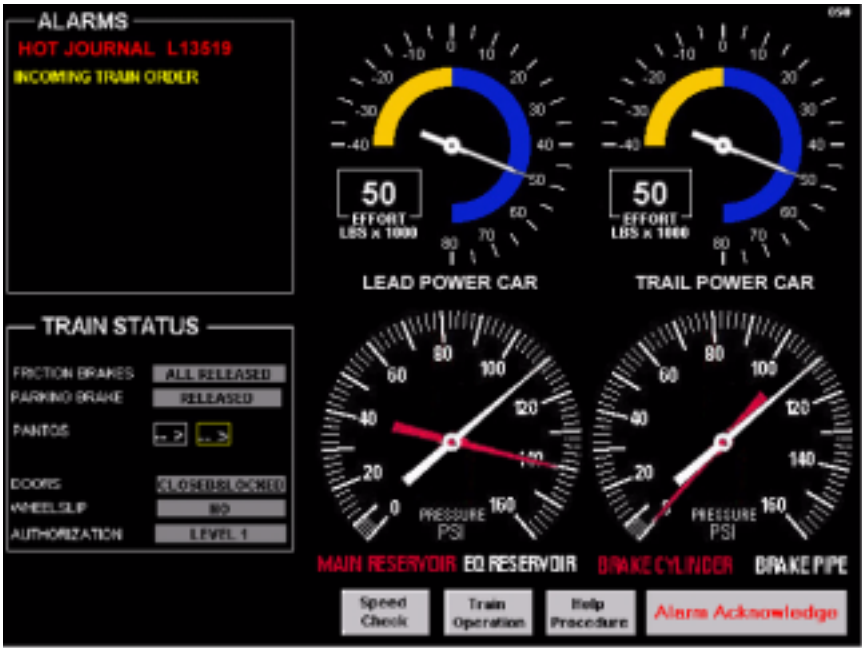


Figure 2-49
Multifunction Display No. 1 Main Operation Page

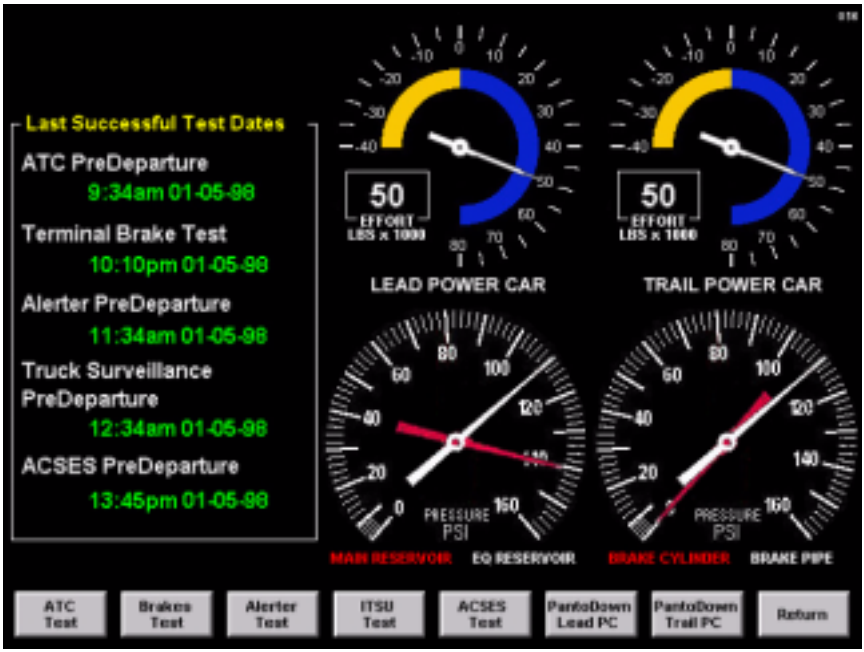


Figure 2-50
Multifunction Display No. 1 Train Operations Page

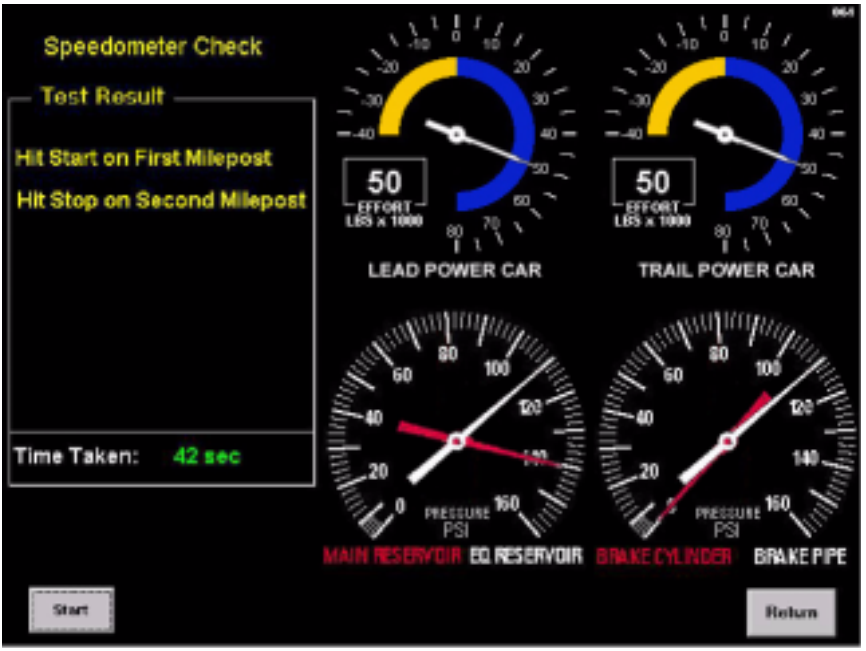


Figure 2-51
Multifunction Display No. 1 Speed Check Page

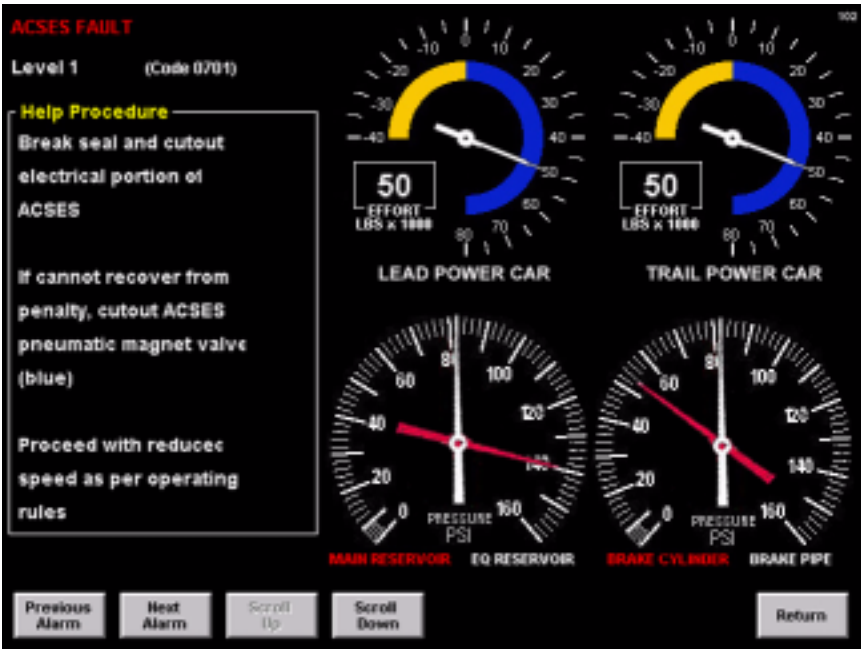


Figure 2-52
Multifunction Display No. 1 Alarm Help Page

2.1.12.8 Multifunction Display No. 2 (Fig. 2-53 to 2-81). Multifunction Display No. 2 (MFD2) is used by the assistant or maintenance personnel. It provides some of the information displayed on MFD1 main operations page. (No alarm help procedures, train operations, or train order handling information is provided.)

It also displays the top level menu for all auxiliary maintenance functions. The main operations page provides access to the subsystem statuses, maintenance events pages, and manual fault entry pages.

MFD2 main operations page displays the following information:

(1) An alarm section, identical to MFD1.

(2) A train operational values section that displays the following operational parameters in analog readouts:

- Brake pipe and brake cylinder pressure (same analog gauge)
- Main reservoir and equalization reservoir pressure (same analog gauge)
- Total electrical traction/braking effort
- Actual Speed digital readout.

(3) A train status section, identical to MFD1.

2.1.12.8.1 Subsystem Status Pages (Fig. 2-54 to 2-75). The subsystem status pages provide information on subsystem health. The top level subsystem status selection page allows the user to get an overall view of the trainset physical configuration.

If an abnormal status is detected, the corresponding subsystem text is highlighted. The subsystem statuses are selected and displayed on a per subsystem group basis. When useful, a button is available presenting a more detailed view.

Most subsystems provide detailed analog parameters as well as discrete statuses. Typical information consists in:

- Pressures
- Temperatures
- Positions (open, closed)
- States (normal/fault, active/inactive, self-test, online/offline).

2.1.12.8.2 PantoDown Lead PC and PantoDown Trail PC Buttons (Fig. 2-50). For car wash operation, the pantograph of both power cars in the trainset can be forced down by using the PantoDown Lead PC and PantoDown Trail PC buttons of the Train Operation Page screen on MFD1. The pantograph of the selected power car is brought down by pressing on the associated numbered key. The pantograph stays down until the key is pressed again.

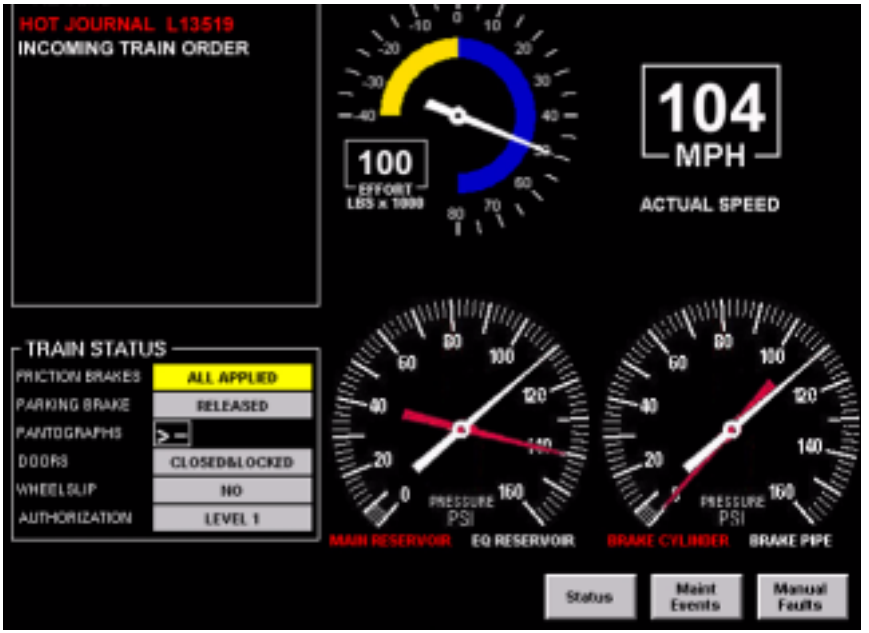


Figure 2-53
Multifunction Display No. 2 Main Operation Page

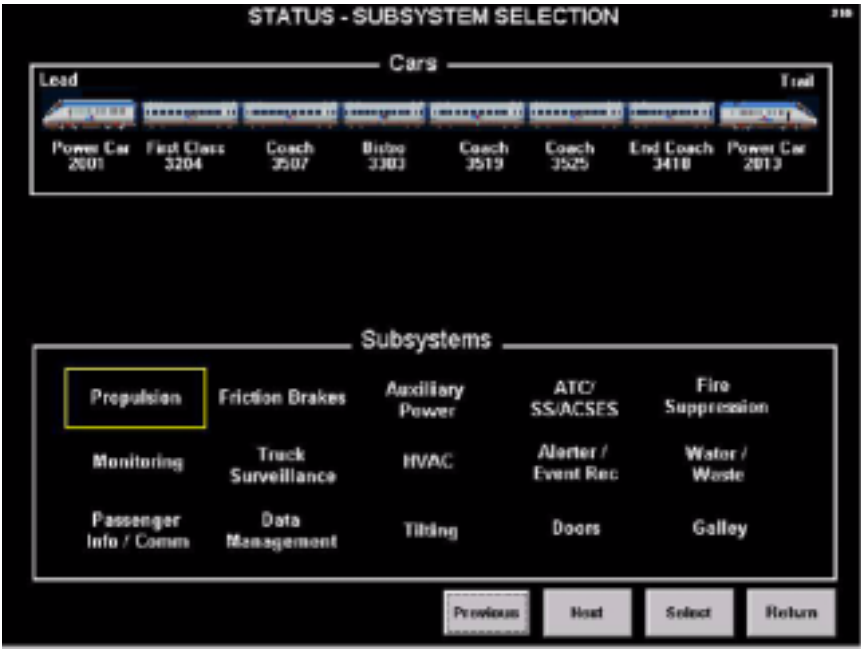


Figure 2-54
Multifunction Display No. 2 Subsystem Status Selection Page

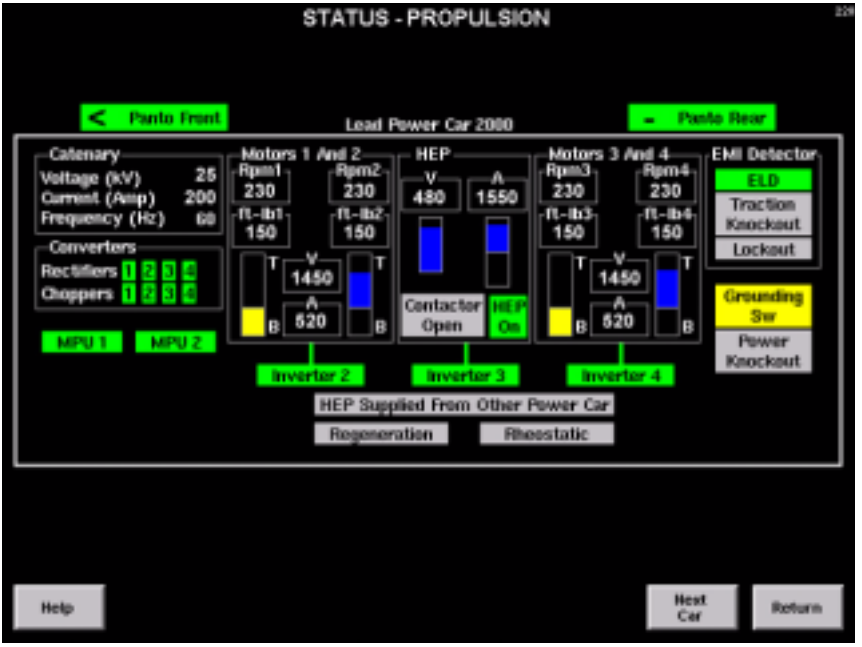


Figure 2-55
Multifunction Display No. 2 Propulsion Subsystem Status Page

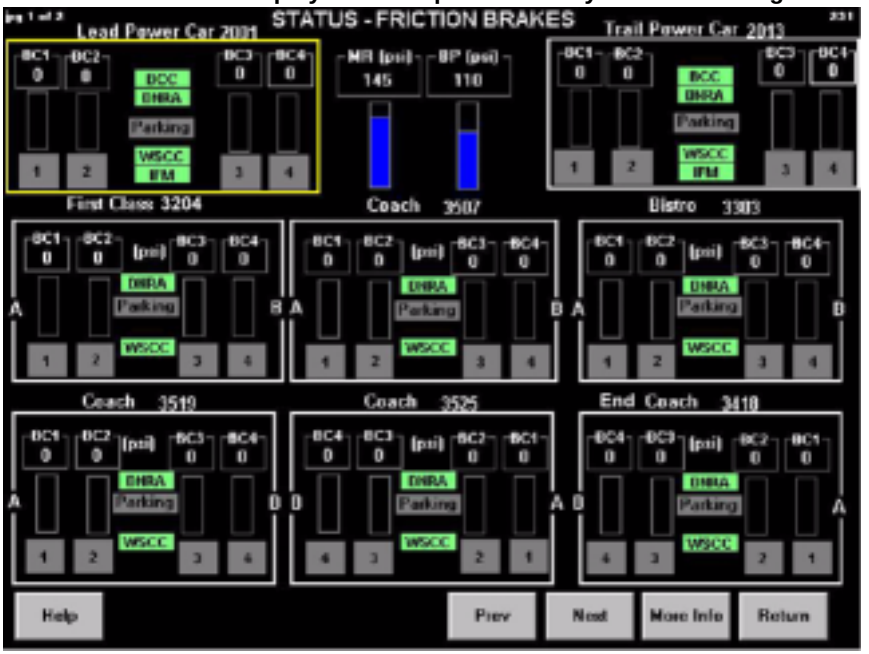


Figure 2-56
Multifunction Display No. 2 Friction Brakes Subsystem Status Page

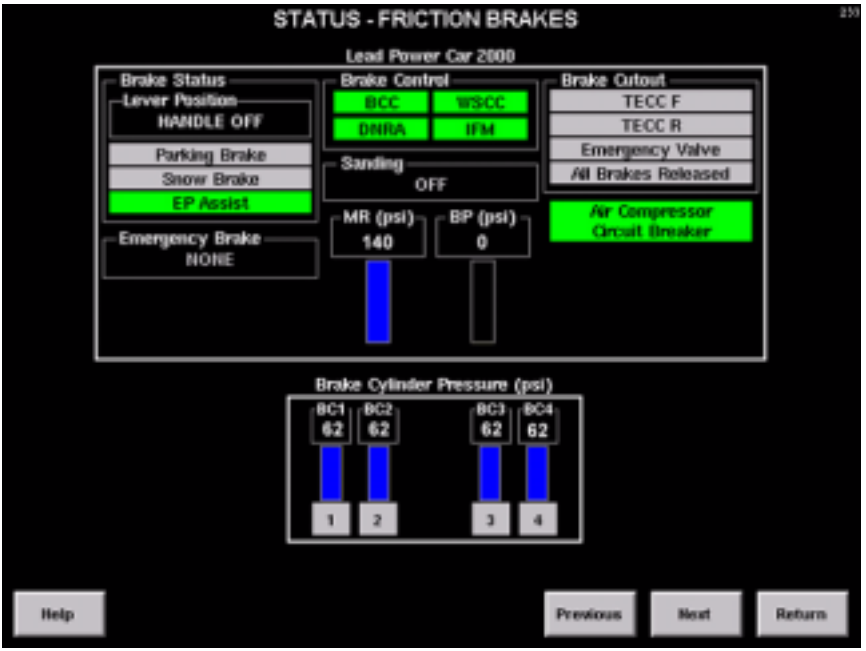


Figure 2-57
Multifunction Display No. 2 Power Car Friction Brakes Status Page

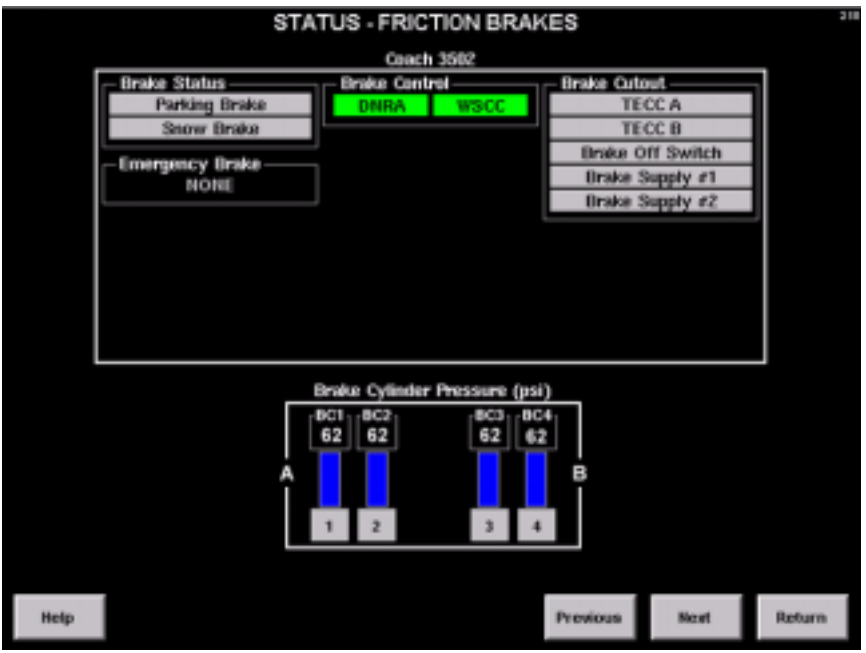


Figure 2-58
Multifunction Display No. 2 Passenger Cars Friction Brakes Status Page

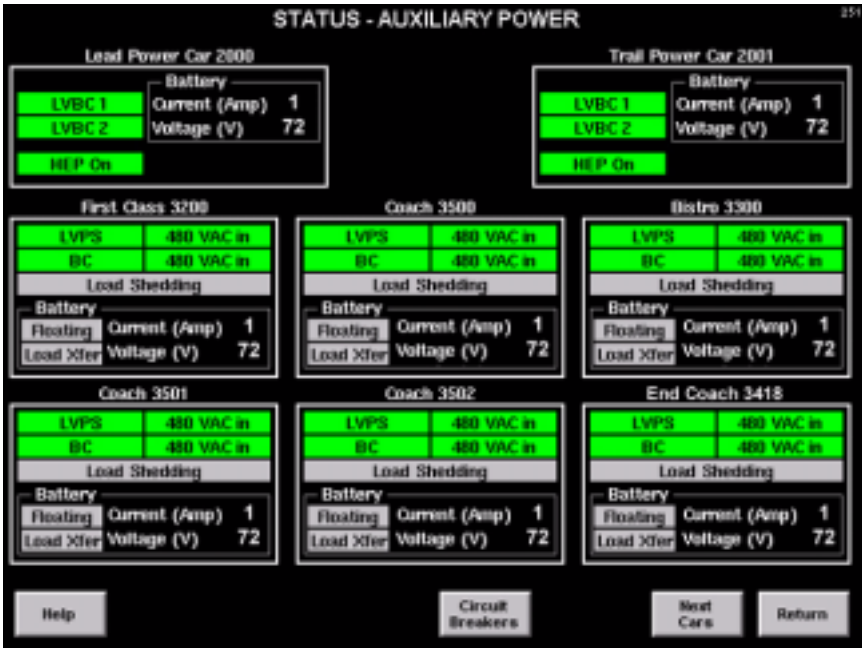


Figure 2-59
Multifunction Display No. 2 Auxiliary Power Subsystem Status Page

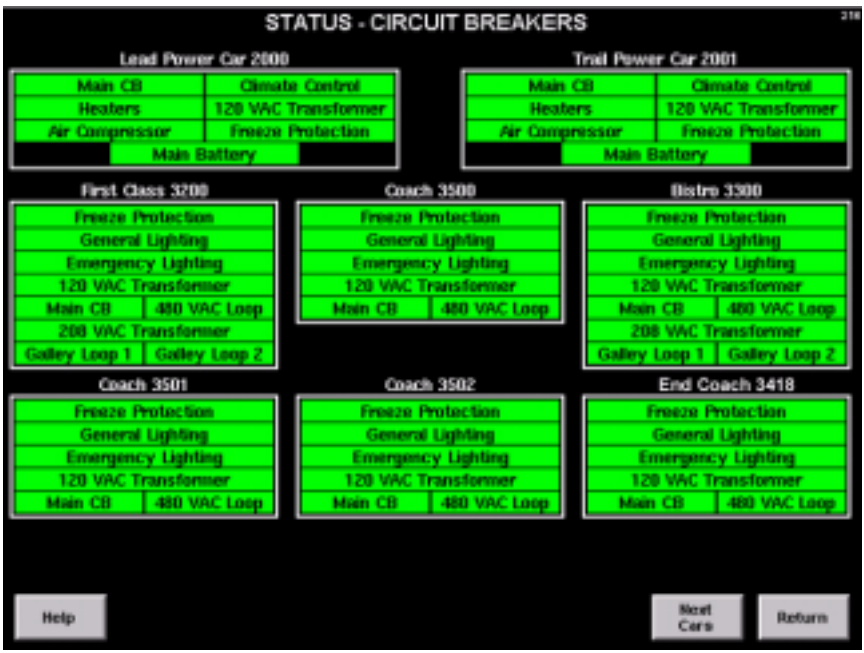


Figure 2-60
Multifunction Display No. 2 Circuit Breakers Status Page

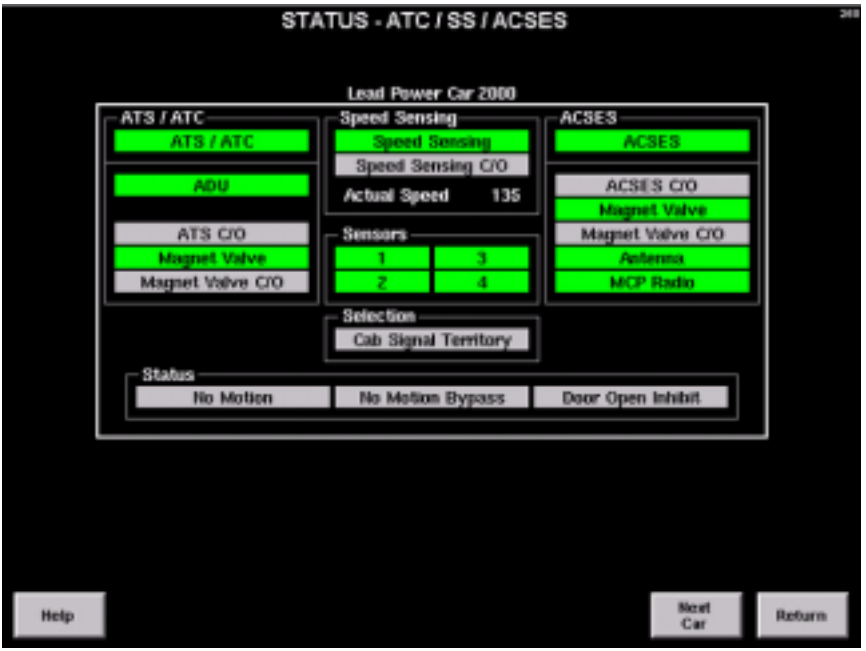


Figure 2-61
Multifunction Display No. 2 ATC/SS/ACSES Subsystem Status Page

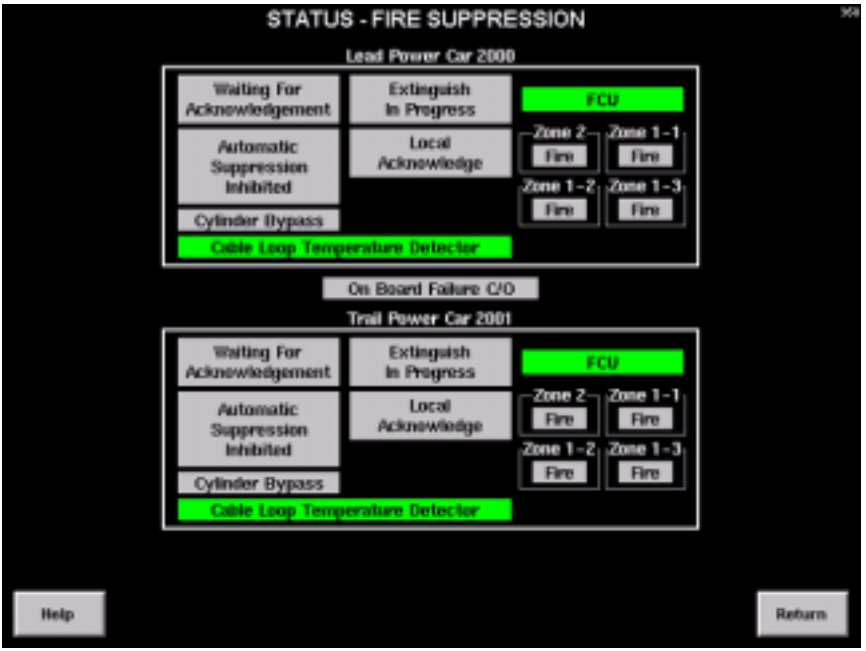


Figure 2-62
Multifunction Display No. 2 Fire Suppression Subsystem Status Page

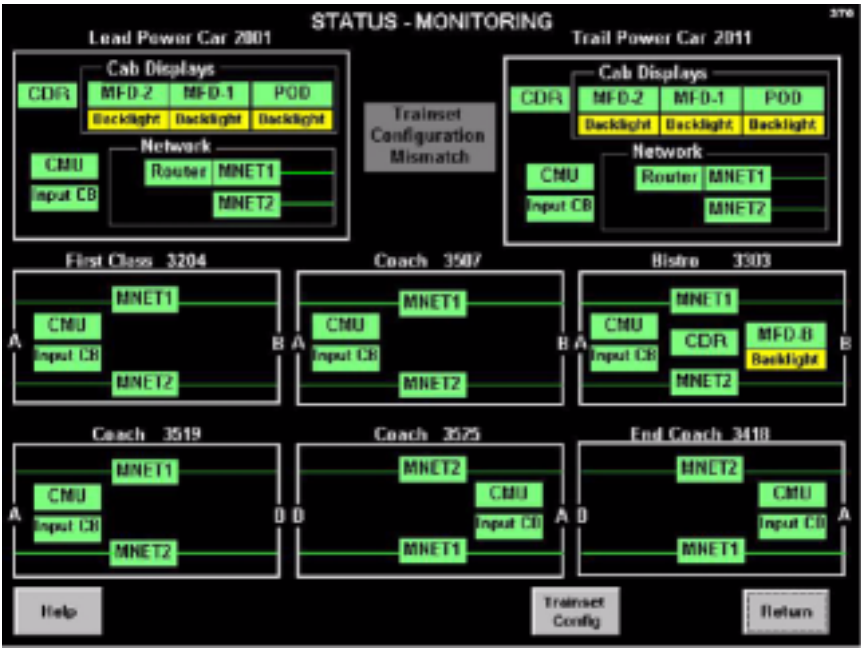


Figure 2-63
Multifunction Display No. 2 Monitoring Subsystem Status Page

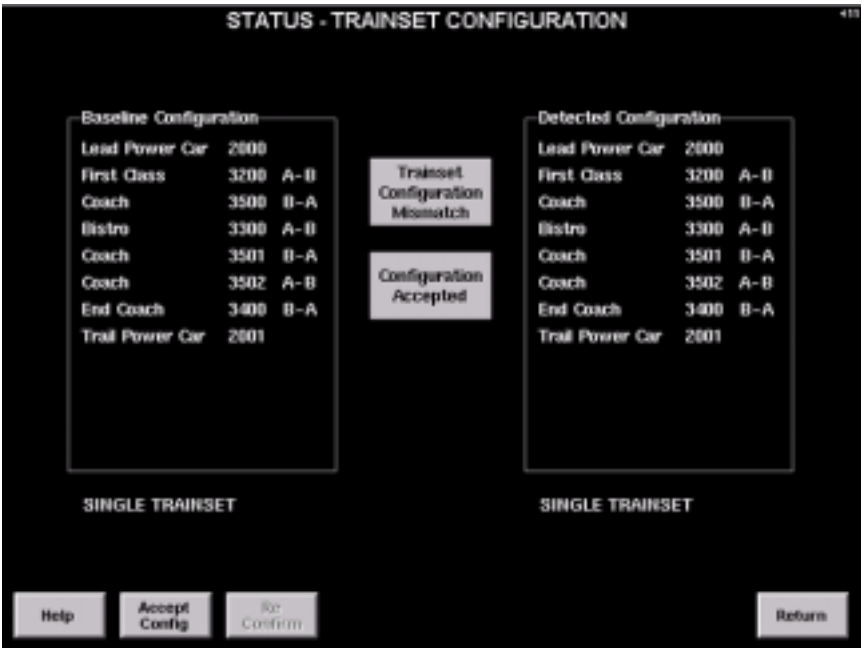


Figure 2-64
Multifunction Display No. 2 Trainset Configuration Status Page

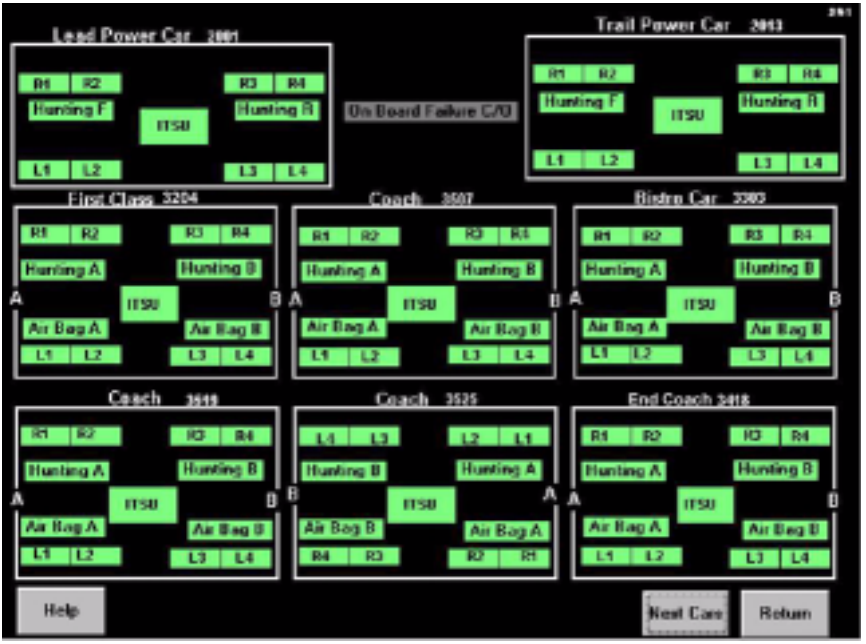


Figure 2-65
Multifunction Display No. 2 Truck Surveillance Subsystem Status Page

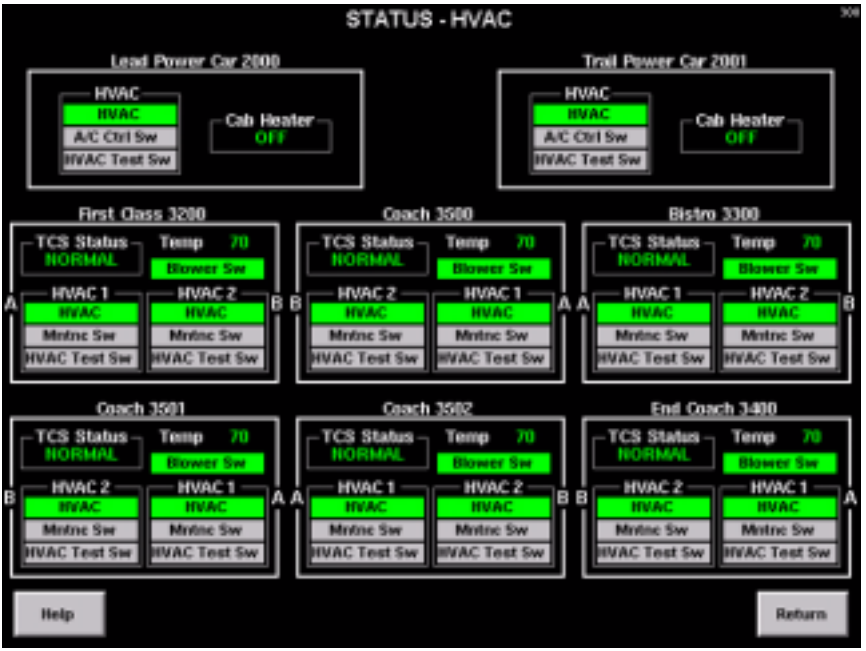


Figure 2-66
Multifunction Display No. 2 HVAC Subsystem Status Page

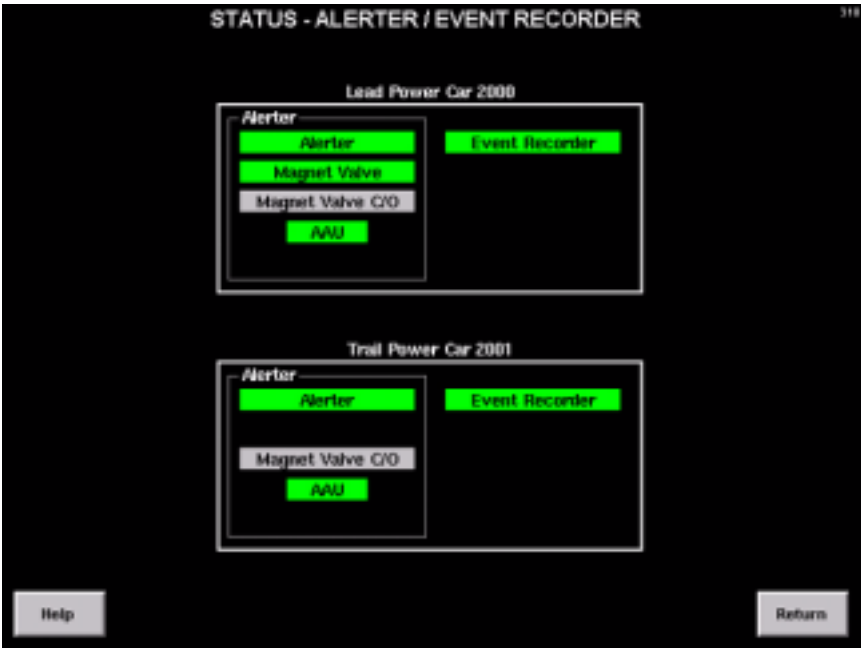


Figure 2-67
Multifunction Display No. 2 Alerter/Recorder Subsystem Status Page

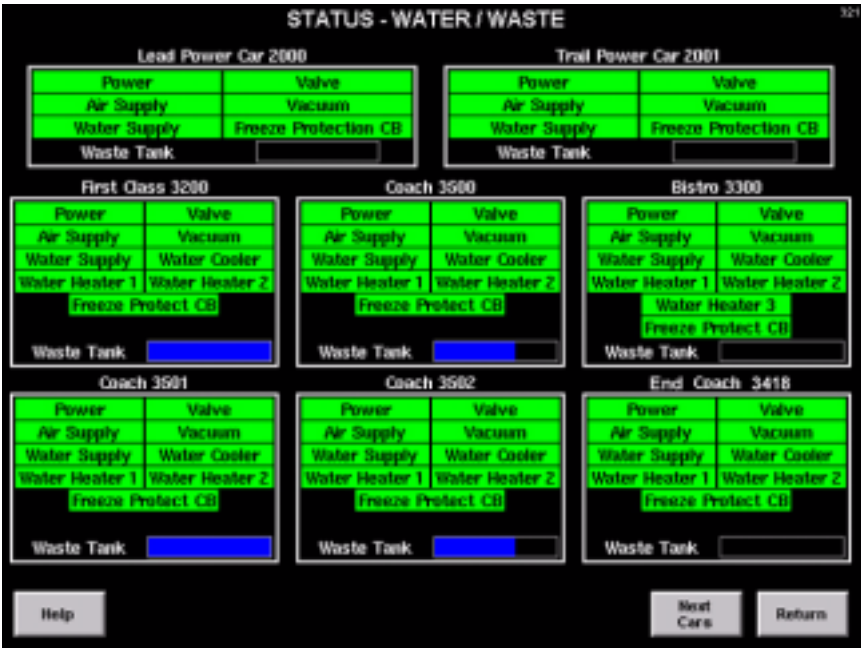


Figure 2-68
Multifunction Display No. 2 Water/Waste Subsystem Status Page

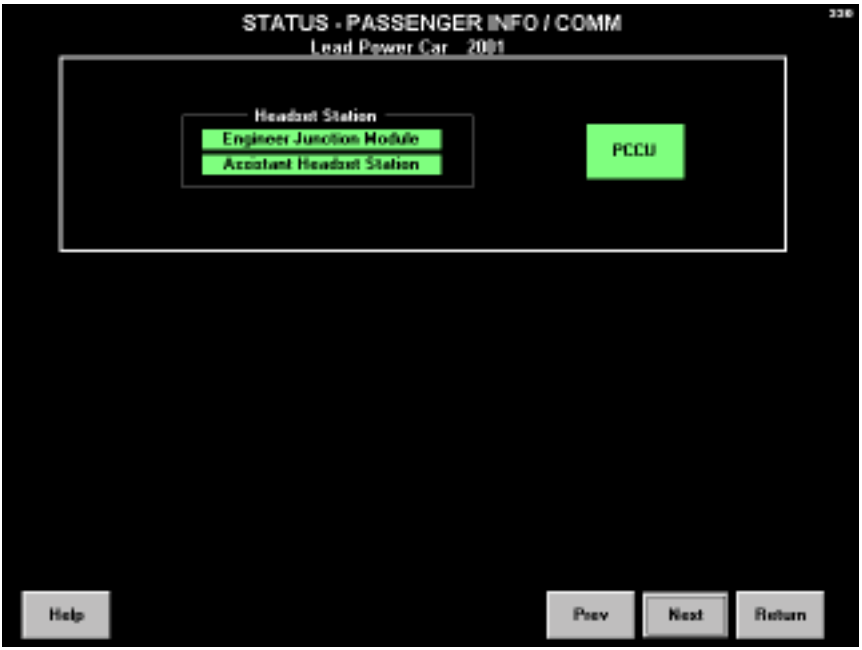


Figure 2-69
Multifunction Display No. 2 Communication Subsystem Status Page

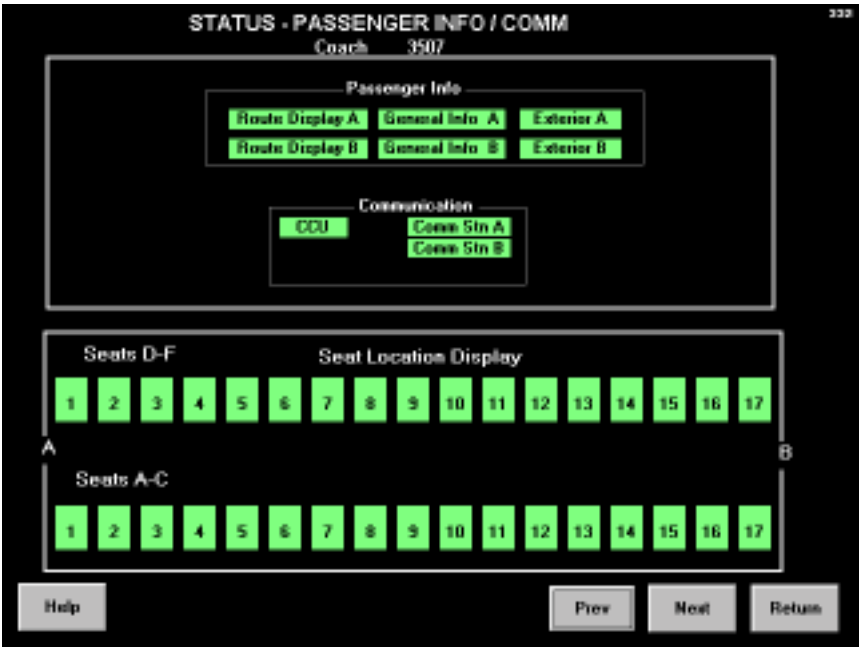


Figure 2-70
Multifunction Display No. 2 Passenger Car Communication Status Page

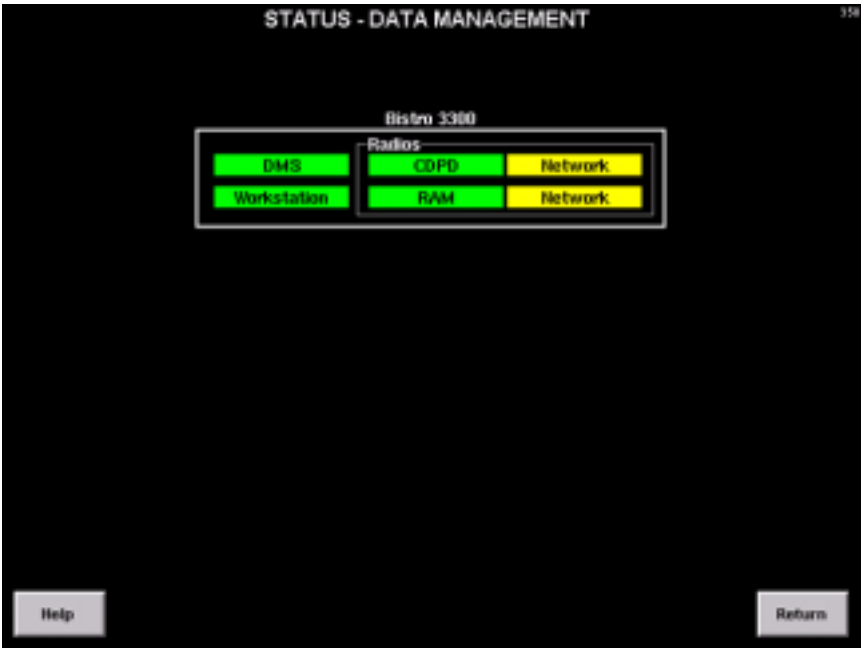


Figure 2-71
Multifunction Display No. 2 Data Management Subsystem Status Page

Figure 2-72
Multifunction Display No. 2 Tilting Subsystem Status Page

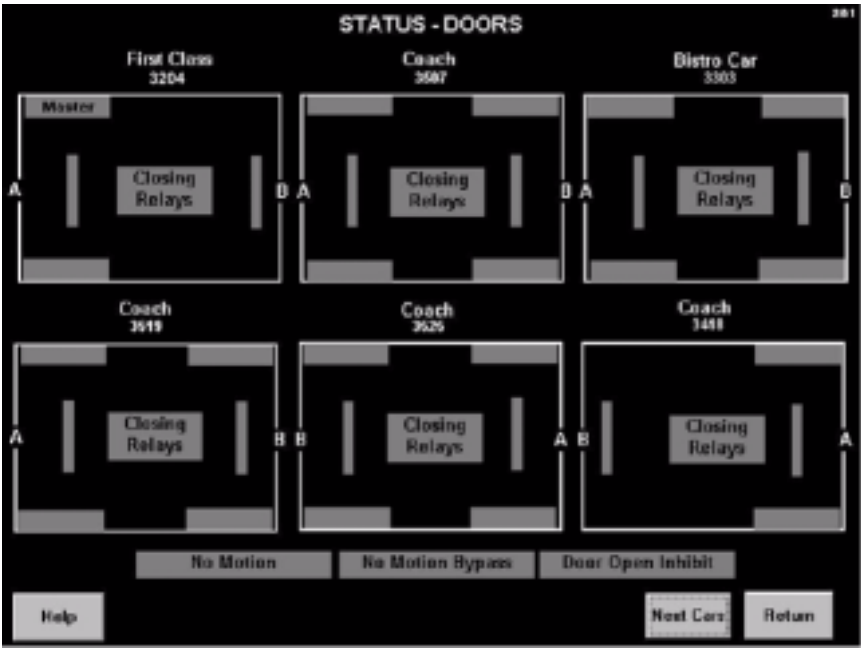


Figure 2-73
Multifunction Display No. 2 Doors Subsystem Status Page

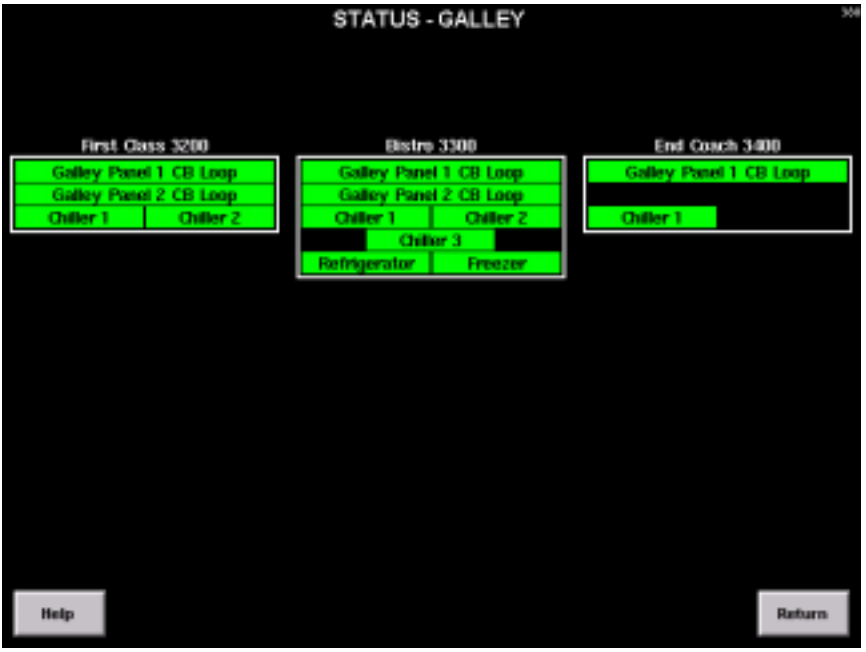


Figure 2-74
Multifunction Display No. 2 Galley Subsystem Status Page

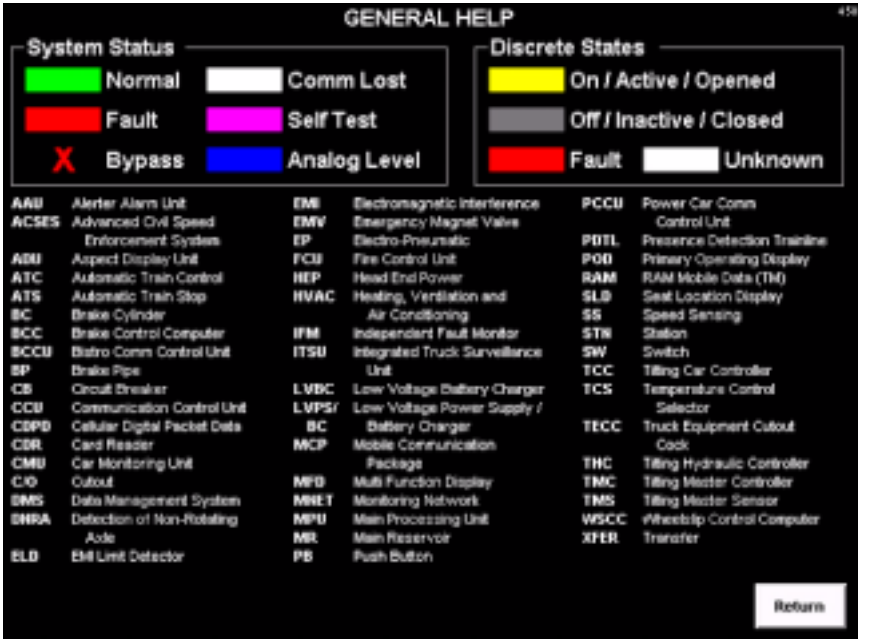


Figure 2-75
Multifunction Display No. 2 Subsystem Status Help Page

2.1.12.8.3 Subsystems Maintenance Events Page (Fig. 2-76 and 2-77). The monitoring system uses a daily log to manage the maintenance events generated by all subsystems. All subsystems track the state (set and reset) of every maintenance event they send to the CMU. The CMU takes all maintenance events that remain in the SET state at the end of a day, and transfers them to the beginning of the new day. This ensures that today's log contains the events that occurred within the last 24 hours, and all events that are still set (even if they were set several days before). Each event describes at least the following:

- Unique descriptive message caption (28 characters)
- Fault code
- Affected subsystem
- Affected car
- Time and date of last occurrence (stamped by the CMU)
- Maintenance event category
- Maintenance event type (set/reset, pulse)
- Geographical position, in mileposts, where the fault occurred (as available from the ACSES)
- Index of the extraordinary report file (if applicable).

The maintenance events selection page is accessed from the main maintenance menu. The maintenance event page gives access to a variety of sorting and filtering options to better isolate the desired data. All events in a specific subsystem group are displayed. The following information can also be displayed:

- Today's events
- Events from a specified date, from today back to a maximum of 5 days (although there is a backlog up to 30 days)
- Events Category (faults, information, maintenance forecasting, manual faults, all categories)
- A choice as to whether or not to view the milepost
- Extraordinary Data Report (EDR) information (it indicates if EDR files are available by specific subsystem)

Default Query (Summary button): This option generates a default maintenance event query to the CMU with the criteria that are desired most of the time.

2.1.12.8.4 Manual Fault Entry (Fig. 2-78 to 2-81). The manual fault entry function gives the opportunity to register an event that is not covered in the automatic portion of the monitoring system.

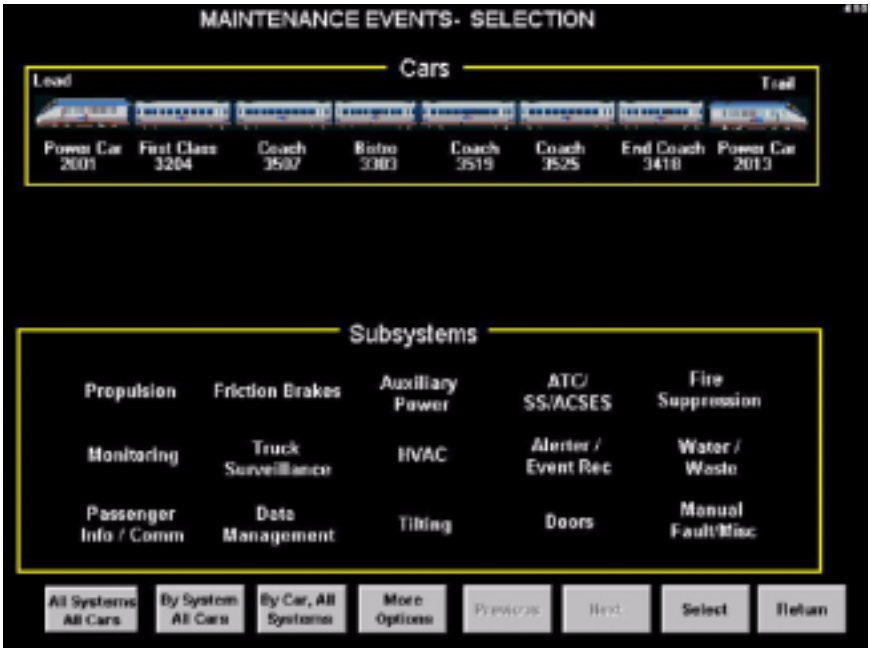


Figure 2-76
Multifunction Display No. 2 Maintenance Events Subsystem Selection Page

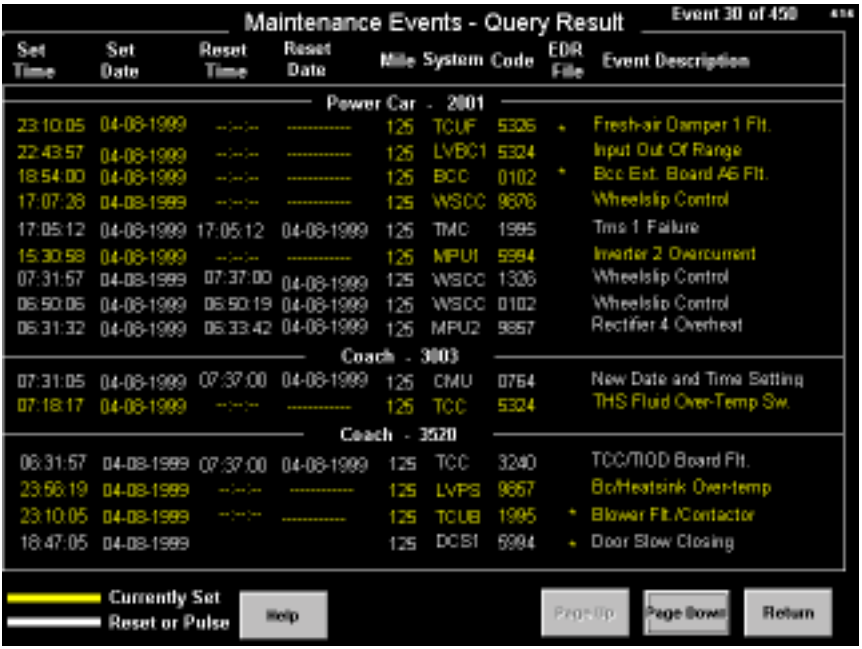


Figure 2-77
Multifunction Display No. 2 Maintenance Events - Query Result Page

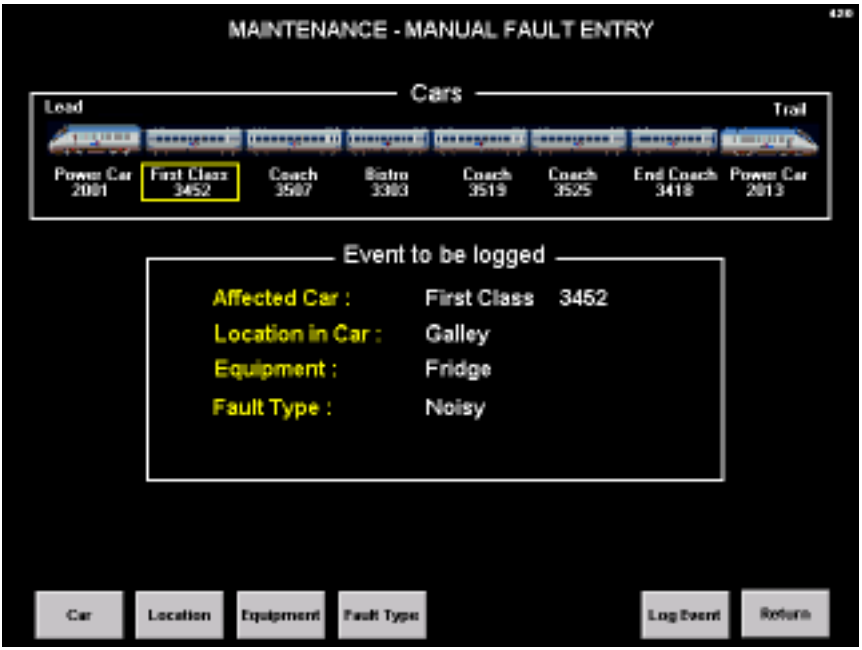


Figure 2-78
Multifunction Display No. 2 Manual Fault Entry Page

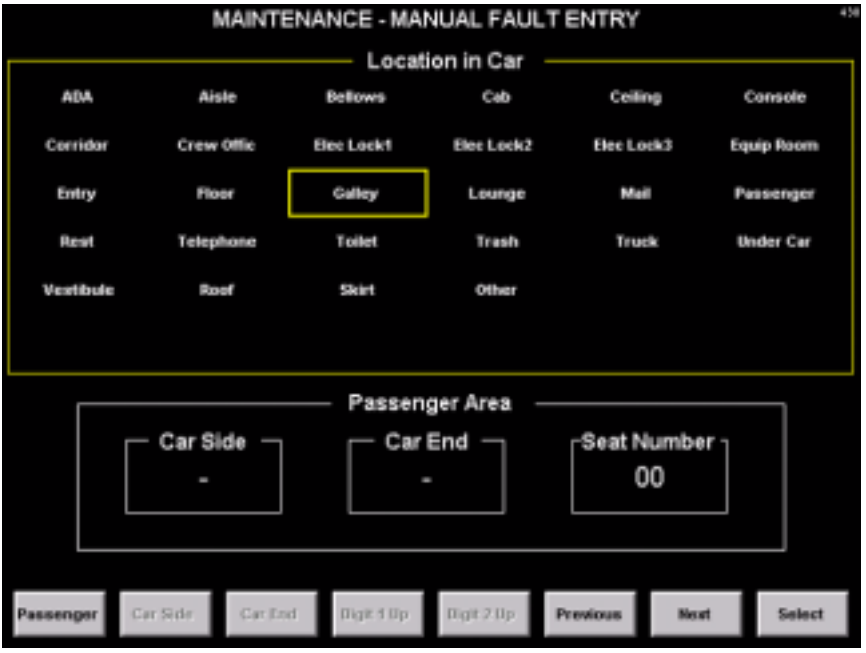


Figure 2-79
Multifunction Display No. 2 Fault Location in Car Manual Entry Page

Figure 2-80
Multifunction Display No. 2 Equipment Type Manual Fault Entry Page

Figure 2-81
Multifunction Display No. 2 Fault Type Manual Fault Entry

2.1.12.9 Multifunction Display Cafe (Fig. 2-82 to 2-87). The Multifunction Display Cafe (MFDB) is located in the crew office of the cafe car. It is used by the train conductor to perform various functions. It is functionally identical to the MFD2, with the exception that the pneumatic pressures and the effort gauge are not displayed on the main operations page.

The main operations displays the following information:

(1) An alarm section, identical to MFD1 and MFD2.

(2) A train operational values section that displays the actual speed digital readout.

(3) A train status section, identical to MFD1 and MFD2.

Five MFDB function keys allow the conductor to select the following

- Public Address Zoning Menu
- Sign and Public Address Menu
- Status Menu
- Maint Events Menu
- Manual Faults Menu

Any valid key card and associated PIN turns on the MFDB screen. Once the display is activated, it remains in this condition until the authorization is logged out or until the car battery power is lost. The MFDB access levels are as detailed in the following table:

Table 2-8
MFDB Access Levels

LEVEL	DESCRIPTION	EQUIPMENT
1	Full access to maintenance data.	MFDB, DMS/WS
2	Full access to maintenance data.	MFDB, DMS/WS
3	Full access to maintenance data.	MFDB, DMS/WS
4	Full access to passenger service data (cafe car only)	MFDB, DMS/WS

2.1.12.10 Display Sign Control Menu (Fig. 2-83 to 2-87). The content of all trainset passenger information signs is controlled by using the Display Sign Control Menu (DSCM). The DSCM is the user interface to the BCCU, and is accessed with the MFDB. It uses the eight MFDB function keys to allow the conductor to select:

- Message to be sent
- Sign(s) where the information is seen
- Car(s) in which this information is seen
- Parameters for public address system zoning.

Figure 2-82
Multifunction Display Cafe Main Operations Page

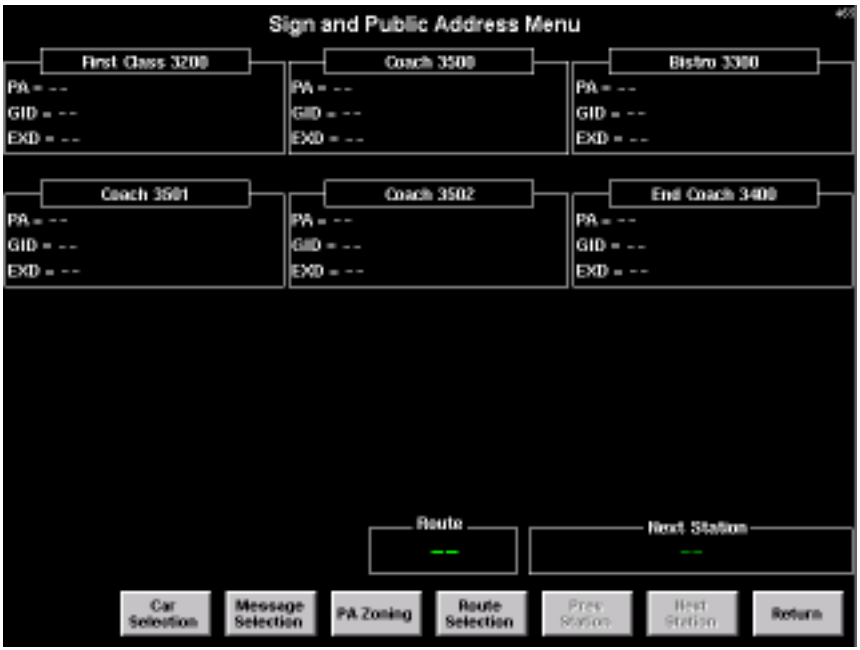


Figure 2-83
Multifunction Display Cafe - Sign and Public Address Menu

Figure 2-84
Multifunction Display Cafe - Car Selection Menu for Signs

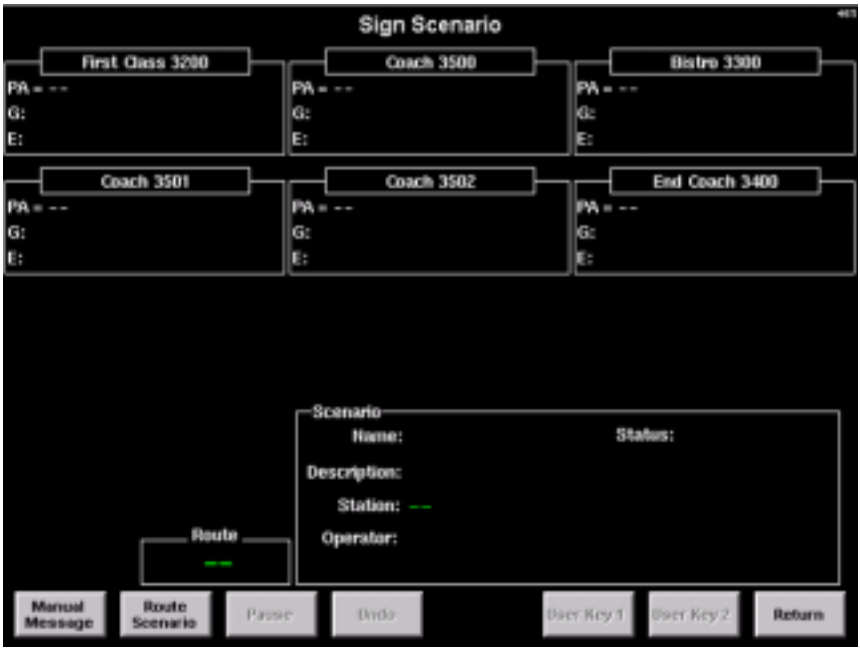


Figure 2-85
Multifunction Display Cafe - Sign Scenario Menu

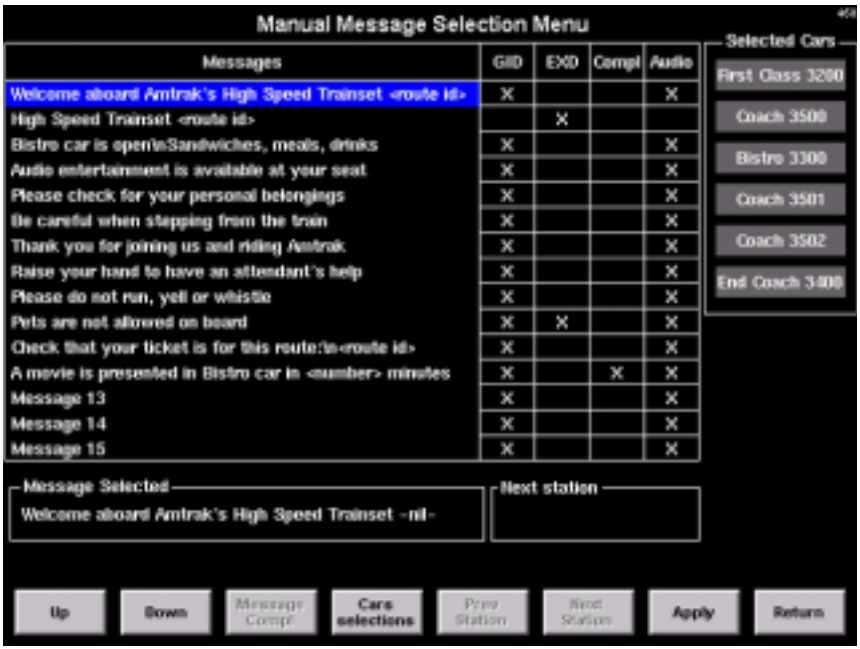


Figure 2-86
Multifunction Display Cafe - Message Selection Menu

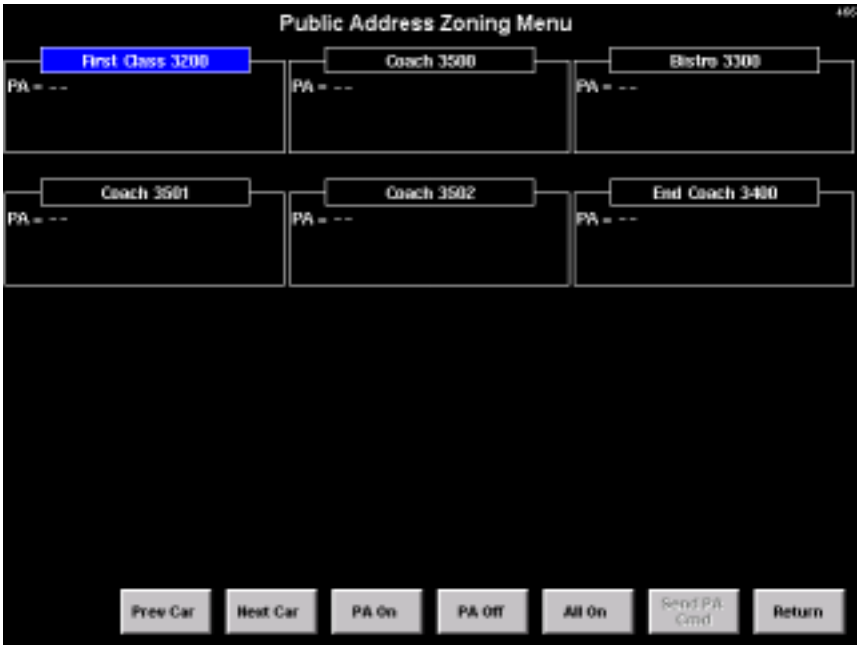


Figure 2-87
Multifunction Display Cafe - Public Address Zoning Menu

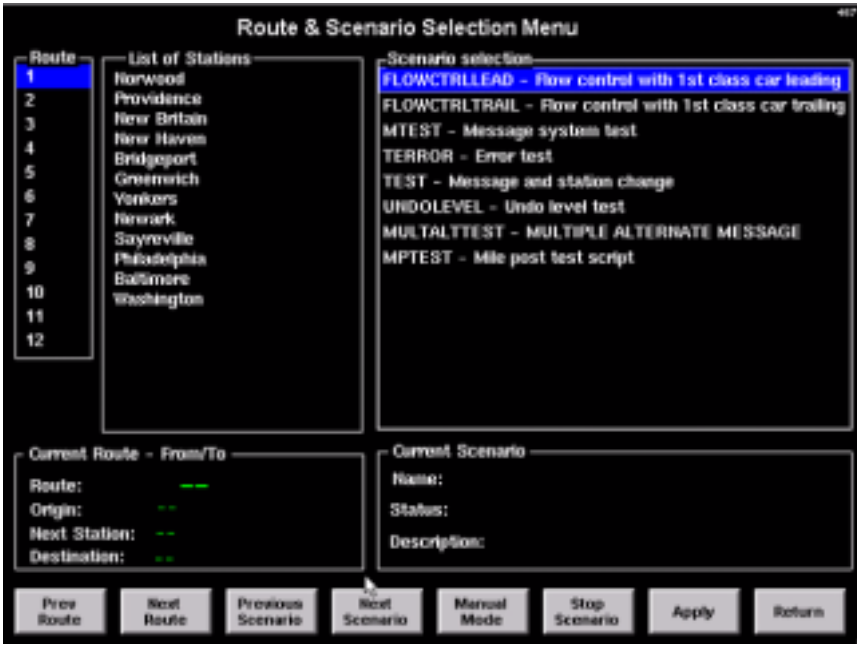


Figure 2-88
Multifunction Display Cafe - Route Selection Menu

2.1.12.10.1 Sign Control Menu. The display sign control menu provides a main window to display the trainset physical configuration and the display signs status for each car. The trainset configuration is obtained from the CMU and the display is formatted to adjust to the different trainset configuration.

The trainset representation provides the following information for each car:

- Car type (power car, coach car, cafe car, end coach car, first class car)
- Car number
- PA zoning status
- General information display sign content
- Exterior display sign content.

The route display sign content is shown below the trainset representation.

Next to the route, the upcoming, next and previous stations are displayed. The conductor can manually select the next station, by scrolling through the available stations, as dictated by the selected train ID and route. The route origin, next station and destination are then displayed on the route display signs.

2.1.12.10.2 Car Selection Menu for Signs. The car selection menu for signs allows the conductor to determine in which car (s) the messages are displayed. The conductor can select all cars and one or more cars (individual or group).

2.1.12.10.3 Message Selection Menu. The display sign message selection menu allows the conductor to set the display signs for a single car or trainset. The general information display sign, the exterior display sign and the PA zoning function are addressable on a per car basis.

The message selection menu provides a drop down list of available messages for each type of display sign. From that list, the conductor is able to select the message to be displayed on a given type of sign.

The list of available messages is shown on the screen. The conductor is able to select one of the messages. By confirming the selection, the new message is transmitted to both general display signs of a specified car(s) or all cars.

As for the general information display signs menu, the conductor is able to select one message from a list of available messages. The selected message is displayed on the signs when the selection is confirmed by the conductor.

2.1.12.10.4 Public Address Zoning Menu. The conductor can control the output of the PA system in a given car. This can be used to create zones in the trainset for specific passenger information messages.

2.1.12.10.5 Route Selection Menu. The route display sign menu is only available when the modify “all cars” option is selected. The conductor is presented with a list of available train identification (ID) numbers. When a train ID is selected, the menu displays the associated origin and destination as well as the stop pattern.

The route display sign information is applicable on a trainset basis only.

2.1.12.11 Sign Control Database. The content of all drop down lists, messages, routes, train ID, etc., is taken from the sign control database. This database is initially resident in the BCCU. It is updated by maintenance personnel using the

communication system PTE. Upon activation on the CIN, the MFDB initiates a database verification with the BCCU. If the database has been modified, the BCCU initiates a transfer of the updated database to the MFDB.

2.1.12.12 Workstation. The crew office is equipped with a laptop computer called the workstation. The workstation enables transfer of information between wayside facilities and the DMS using the data radios. It is used as the interface for most passenger related services and certain maintenance related functions. It is located on a pullout shelf that can be stowed away in the rack when not in use. The external keyboard rests on two brackets and it can be removed from the rack when in use. The workstation trackball is used on the crew office work surface.

Most passenger related services are either applications running on the workstation, or are peripheral devices connected to it.

2.1.12.13 Free Text Message. The workstation allows the input of a 24-character message. The text input is transferred through the DMS to the MFDB. This message appears at the end of the message selection list for general information displays. Only one message is supported, a new message overwrites the previous entry in the list.

2.1.12.14 Point Of Sale. The Point Of Sale (POS) is an intelligent cash register connected to the workstation. It is located in the galley area of the cafe car, and is used to log cash transactions for food and beverages aboard the train. A credit card scanner is connected to the POS to log credit card transactions.

2.1.12.15 Commissary Reports. The commissary report is a data file generated by the POS and transmitted to the wayside facilities. It is used to maintain an up-to-date inventory of on-board food and beverage This ensures that wayside facilities can prepare the required merchandise prior to train arrival at the station.

All activities related to the generation of a commissary report are performed by the POS. When a commissary report has been completed, it is transferred from the POS to the DMS for transmission over the commercial wireless networks.

2.1.12.16 Arrow Reservation System. The Arrow reservation system comprises a wayside server application and an onboard client application. The Arrow terminal emulator application package provided by Amtrak allows the train crew to access the Arrow reservation system functions. The train crew is able to upload, and edit passenger manifests.

The user can access the passenger manifest update functions through the workstation. The user is prompted with two choices:

(1) Update the Arrow passenger manifest file.

(2) Update the Seat Location Display passenger manifest file.

Through the Arrow terminal emulator, the user can request the complete passenger manifest file from the wayside server. The Arrow application creates a reduced format manifest file, containing only the fields needed to update the seat location displays.

When the user selects an update of the SLD manifest file, the reduced file is transferred from the workstation, through the DMS, to the BCCU. The BCCU can then use the file information to update the SLDs with the destination of the reserved seat passenger.

The user can, through the BCCU, modify the content of the SLDs and simultaneously, the reduced passenger manifest file. By selecting to update the Arrow manifest file, the user requests a transfer of the file from the BCCU, through the DMS, to the workstation.

2.1.12.17 Arrow Credit Card Transactions. A credit card scanner is connected directly to the workstation. It is used for payment of train ticket purchases. The validation of the credit card transaction is controlled by the Arrow application. When a credit card transaction authorization request is required for a ticket purchase, the request is forwarded by the DMS to the wayside address. The validation result is then forwarded to the workstation by the DMS.

2.1.13 WATER AND WASTE RETENTION SYSTEMS (Fig. 2-89 to 2-91).

2.1.13.1 Potable Water Fill Points. The potable water reservoir can be filled from either side of each car. The fill points are accessible from under the skirt. They consists of a hose fitting protected with a cover and a three-way valve. The three-way valve allows the compressed air of the water raising system to be cut off and vented while refilling the water tank. A water overflow discharge pipe is located directly below each water fill point.

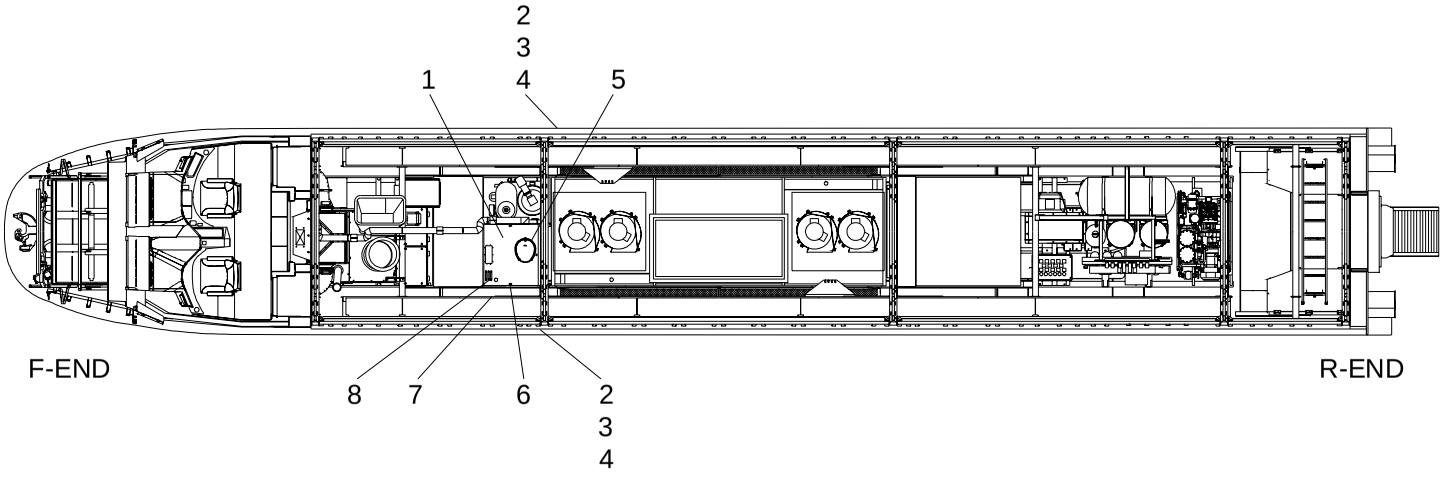
2.1.13.2 Waste Retention System Controls. The waste collection and retention system is controlled by the equipment described in the following subsections.

2.1.13.3 Central Control Panel. The central control panel, behind the access panel of the toilet module, drives all the indicators. The following conditions are monitored:

- Power off
- Low air
- Low water
- No vacuum
- Valve open
- Tank full, 2/3 full, and empty.

2.1.13.4 Waste Tank Status Panel (Fig. 2-91). The waste tank status panel provides a visual status of the system using LEDs with the following indicators:

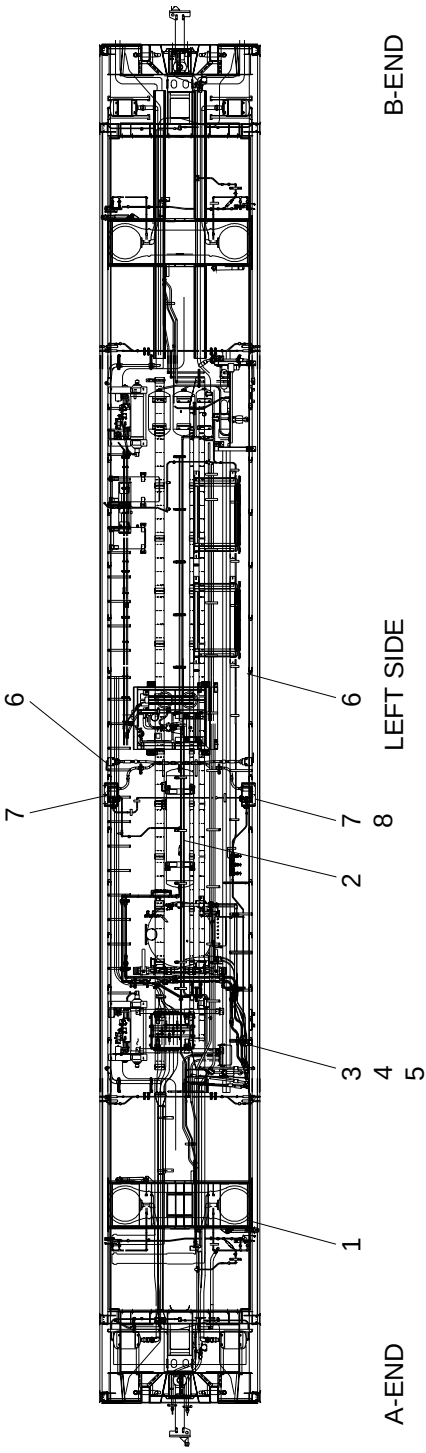
- TOILET SYSTEM: yellow (activates together with any indicator below)
- POWER OFF: red (HEP, or CB43, waste collection and retention circuit breaker, or disconnect switch off)
- LOW AIR: red (low air pressure in toilet)
- LOW WATER: yellow (water tank less than 1/3 full)
- NO VACUUM: red (low vacuum)
- VALVE OPEN: red (tank drain valve or manual vent valve open)
- TANK FULL: red (waste tank full)
- FULL: yellow (waste tank 2/3 full)
- TANK EMPTY: green (waste tank empty).



AB130002

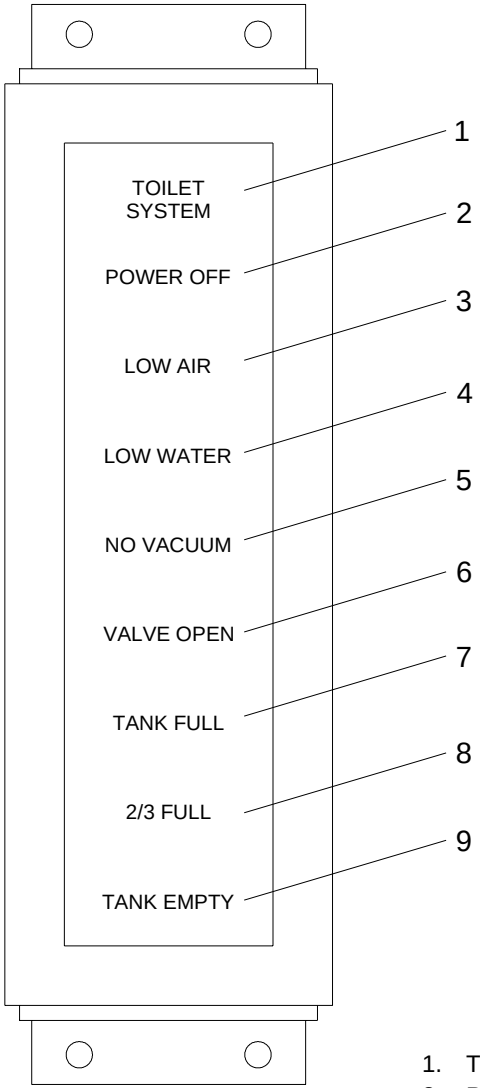
1. Waste Tank
2. Water Fill Station
3. Undercar Service Lines
4. Water Raising Unit
5. Toilet Module
6. Central Controller
7. Waste Tank Status Panel
8. Water Tank

Figure 2-89
Power Car Water System Components Location



1. Waste Tank
2. Water Fill Station
3. Undercar Service Lines
4. Water Raising Unit
5. Toilet Module
6. Central Controller
7. Waste Tank Status Panel
8. Water Tank

Figure 2-90
Passenger Car Water System Components Location - Typical



1. TOILET SYSTEM Yellow LED
2. POWER OFF Red LED
3. LOW AIR Red LED
4. LOW WATER Yellow LED
5. NO VACUUM Red LED
6. VALVE OPEN Red LED
7. TANK FULL Red LED
8. FULL Yellow LED
9. TANK EMPTY Green LED

AB130001

Figure 2-91
Waste Tank Status Panel

2.1.13.5 Waste Tank Empty LEDs. Each passenger car is equipped with a LED display that indicates when the tank is empty. The display is installed under-car, on each side of the tank. The words WASTE TANK EMPTY are visible when the side skirts are opened.

2.1.13.6 Water Filling. Connect hose to hose fitting and allow water to flow into tank.

NOTE:

Water escaping from pipe indicates that tank is full.

Once tank is full, return valve handle to WATER position and disconnect hose.

SECTION 2.2
OPERATION

2.2.1 HEP OPERATION. This subsection describes the trainset Head End Power (HEP) operation.

HEP (480 Vac, three-phase, 60 Hz) feeds all the trainset equipment. The trailing power car provides 480 Vac power to the passenger cars. The leading power car only feeds its own loads, and backs up the other power car. When the trailing power car MPU becomes defective, the trainset 480 Vac loads are automatically connected to the leading power car MPU.

The MPU of both power cars in a trainset start when high voltage is present, and auxiliary inverters become ready. The auxiliary inverter, located in the auxiliary block, is the first inverter to be activated at startup. The auxiliary inverter fed by the dc-Link produces a 1780 Vac, three-phase, 60 Hz output that the auxiliary transformer, located in the main transformer, steps down to produce the HEP. The propulsion electronic control unit also controls the auxiliary inverter.

NOTE:

HEP power is available only if the 480 Vac wayside receptacle access panels are closed at both ends of the trainset and 480 Vac trainlines are connected through the entire train consist. If the 480 Vac trainline loop integrity is lost when the train speed higher than 5 mph, the HEP is still supplied.

The HEP switch on the engineer's overhead switch panel enables the removal and reapplication of the HEP power to the passenger cars. In ON position, the switch is operational only in the active cab. The OFF position of the switch is operational all the time.

To supply the passenger cars, the HEP switch is turned on.

2.2.2 PREPARATION FOR OPERATION. This subsection describes the procedures that have to be performed before a trainset is put in service.

Trainset power-on is achieved, from the leading power car of the trainset. Once the pantographs are raised, the main circuit breakers close, the machine room power units start up, and head end power is available to be applied to the passenger cars.

To prepare the trainset for operation, proceed as follows:

(1) Press step lighting pushbutton, near entrance door or at bottom of ladder, to turn on access lighting for one minute.

(2) Press CAB ACTIVATE button on cab rear wall switch panel to activate monitoring system, key card reader, propulsion control, and auxiliary compressor.

(3) Check that key card reader green LED, and ONBOARD FAILURE red indicator come on, and ADU is energized.

NOTE:

Auxiliary compressor starts automatically when main reservoir air pressure is too low to allow pantograph raising.

(4) Apply key card against key card reader reading surface.

Key card reader LEDs indicate the following:

NOTE:

Key card reader beeps whenever a status LED is flashing.

- Green LED continuously lit: Key card reader is ready to accept a card.
- Green LED flashing: Card accepted.
- Red LED continuously lit: Key card reader fault.
- Red LED flashing: Key Card rejected.

(5) Type a valid PIN number on keypad. This authorizes operation of reverser, with traction limitations imposed by access level.

(6) Set reverser to N (Neutral) to enable cab controls.

NOTE:

If cab is authorized with reverser in another position than OFF, and throttle is in a power position, cycle throttle to "0" and back to power positions to get propulsion controls.

(7) If reverser manipulation is not possible, check that all the other reversers in the trainset are in OFF. If any other cab reverser has been left in another position, correct problem first. (This condition is shown on MFD2.)

(8) Check that ONBOARD FAILURE red indicator comes off.

(9) Check that ONBOARD FAILURE green indicator, POD, and MFD1 come on.

NOTE:

The ADU displays the current aspect as received from the track.

(10) Check that the PANTO-DOWN pushbutton is not in down position. If required, press pushbutton down to reset it.

(11) Press PANTO-UP pushbutton on engineer's overhead switch panel to raise the pantograph. (If auxiliary circuit air pressure is too low, wait until auxiliary compressor has charged it.)

NOTE:

Check on MFD1 that proper pantographs raise as per automatic configuration (trailing pantograph for each power car). If not, verify that each car pantograph local selector is set to AUTO and that there is no PANTO-DOWN pushbutton in down position.

(12) Place MCB switch on engineer's overhead switch panel in AUTO.

NOTE:

Each power car main circuit breaker closes if catenary voltage is sensed (when pantograph is raised.)

(13) Verify ABCL is in HO position.

(14) Cut in BP charging by placing BRAKE VALVE C/O switch on engineer's desk right switch panel in PASS. (passenger cars) position.

(15) Place TILTING switch on engineer's left switch panel in ENABLE position to enable tilting system for whole trainset.

(16) To supply passenger cars, turn momentary HEP switch on engineer's overhead switch panel to ON.

(17) Place reverser in FWD or REV position to select a direction of travel.

WARNING:

MAKE SURE THAT THE PARKING BRAKES ARE APPLIED BEFORE PLACING THE ABCL IN RELEASE POSITION.

(18) Place ABCL in REL position.

(19) Place throttle lever in READY position to activate traction mode.

NOTE:

Parking brakes are automatically released when the throttle is moved towards the EFFORT zone.

2.2.3 SEAT ADJUSTMENT (Fig. 2-92). To adjust the engineer's seat and the assistant's seat, use the controls shown on Figure 2-92. The adjustments available are as follows:

2.2.3.1 Seat Height. The height adjusting knobs allow 5.25 inches of vertical height adjustment. If excessive resistance is encountered, turn the knob while standing away from seat cushion.

2.2.3.2 Seat Tilt. The seat tilt knobs allow eight degrees of seat cushion angle adjustment. Seat tilt is independent of seat height adjustment to allow full tilt range at all seat heights.

2.2.3.3 Seat Back Recline. The seat back recline knobs allow an adjustment of the seat back angle from 45 degrees forward to 110 degrees backward.

2.2.3.4 Lumbar Support. The lumbar support adjustment knobs increase the amount of lumbar support when rotated forward, and decrease it when rotated backward.

2.2.3.5 Fore/Aft Slide. The slide handle allows the seat to move front to back when pulled up to release the seat lock.

2.2.3.6 Suspension Lockout/Limitor. The lockout/limitor allows the following settings:

- Outward position: Full suspension range
- Middle position: Limits the vertical suspension range
- Far right position: Locks out the suspension.

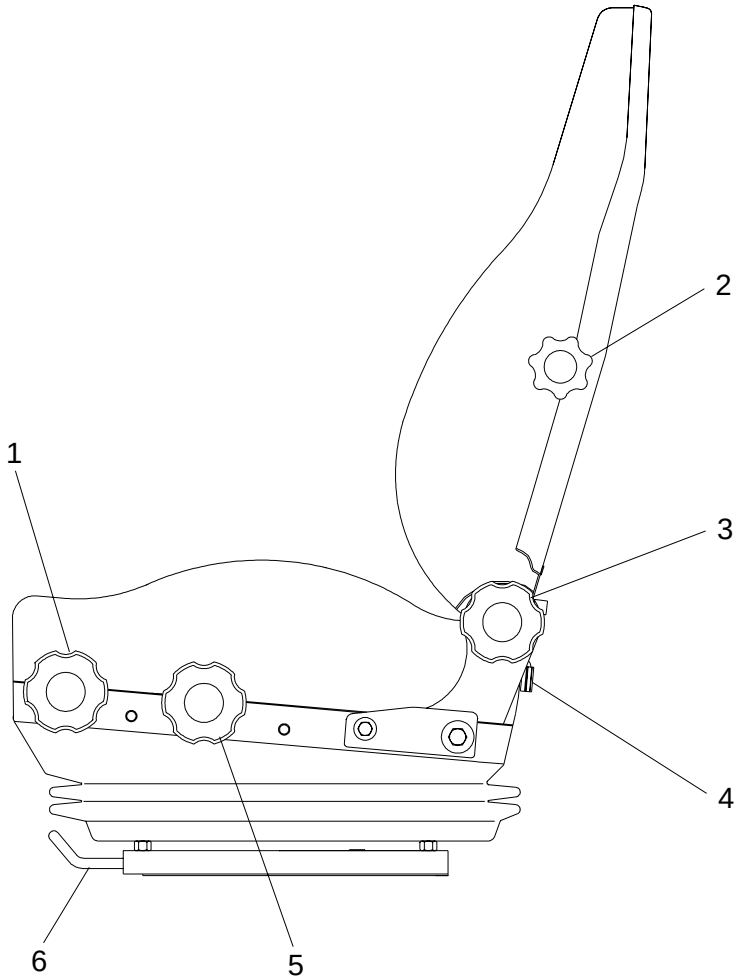
NOTE:

To engage the lockout, the seat must be in the middle height position.

2.2.4 FOOTREST ADJUSTMENT (Fig. 2-93). To adjust the engineer's adjustable footrest, use the FOOTREST switch located below the engineer's center console switch panel.

NOTE:

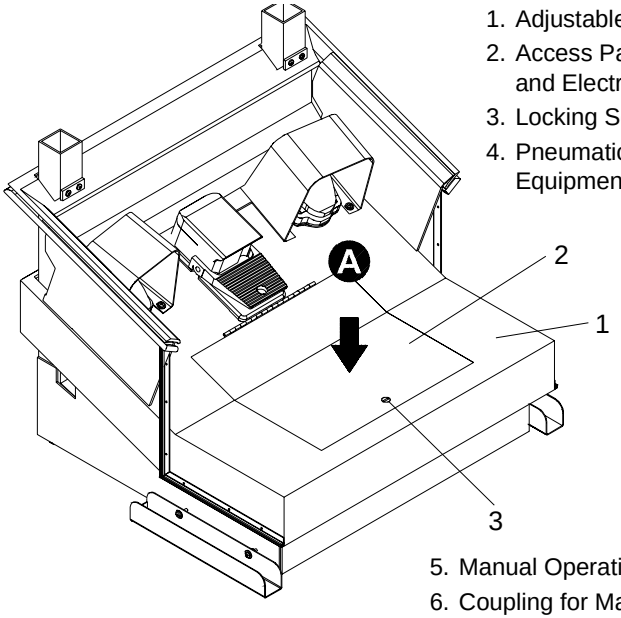
If the switch is defective, the adjustable footrest can be adjusted manually.



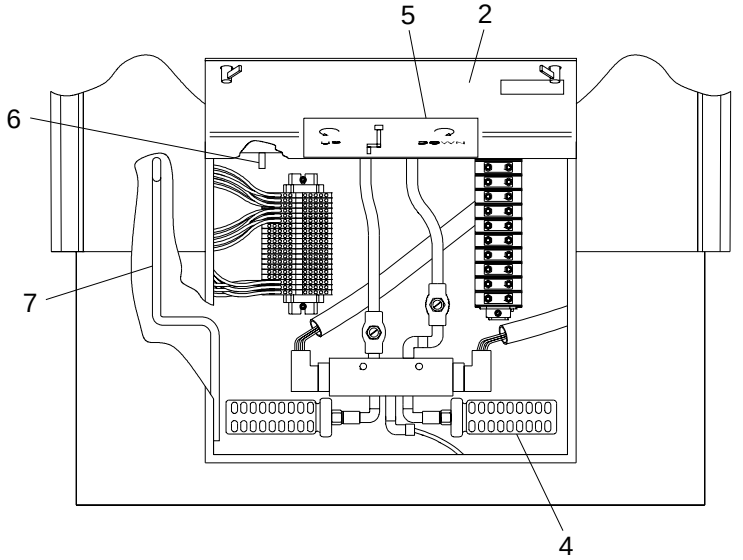
1. Height Adjusting Knob (Turn Towards the Seat Front to Lower, Towards the Seat Back to Raise)
2. Lumbar Support Adjustment Knob
3. Seat Back Recline Knob
4. Suspension Lockout/Limitor
5. Seat Tilt Knob
6. Fore/Aft Slide Handle (Pull Up to Move)

AB150011

Figure 2-92
Engineer's Seat and Assistant's Seat



1. Adjustable Footrest
2. Access Panel to Pneumatic and Electric Equipment
3. Locking Screw
4. Pneumatic and Electric Equipment
5. Manual Operation Description Label
6. Coupling for Manual Operation
7. Handle for Manual Operation



VIEW A

Figure 2-93
Adjustable Footrest

2.2.5 TRAINSET DEPARTURE TEST. The departure test is carried out in both power cars of the trainset once every calendar day prior to the departure of the maintenance facility.

2.2.5.1 Preparation for Test. The departure test is carried out after the corrective and preventive maintenance activities have ended in both cabs of the trainset.

NOTE:

The tests steps designated with an * are only required to be completed in the first active lead power car.

If any time any of the test fail, note it on the test report including the step the test failed and notify a supervisor.

NOTE:

Two persons are required to perform the departure tests. Proceed as follows:

WARNING:

PRIOR TO BOARDING, ENSURE THE TRAINSET IS SECURED, WITH WHEEL CHOCKS IN PLACE AND 480 V WAYSIDE POWER DISCONNECTED.

1) Verify if following equipment is in indicated position:

EQUIPMENT	POSITION	LOCATION
Battery Main Circuit Breaker, CB50	ON	Equipment room R-End
Pantograph Local Selector	AUTO	Propulsion Electrical Cubicle
Pressure Pantograph Switch	AUTO	
Key Card Reader Bypass Switch and Fire Control Unit Bypass Switch	NORMAL, sealed	
Emergency Magnet Valve Cutout Cock (EMVCC)	Open position (lever vertical)	Equipment Room R-End, right side
ATC cutout switches (ATSCO/SSCO)	IN, sealed	ATC Equipment Rack
Alerter Cutout Switch	NORMAL, sealed	Electrical Locker No. 2
CAB TERRITORY Switch ONBOARD TL Switch	IN, sealed NORMAL, sealed	Cab Rear Wall Switch Panel
Automatic Brake Control Lever	HO (Handle OFF)	Both cabs
Reverser	OFF	Both cabs
BRAKE VALVE C/O Switch	OUT	Both cabs
PANTO-DOWN Pushbutton	Not maintained in "DOWN" position	Both cabs
MCB Switch	AUTO	Engineer’s Overhead Switch Panel

2) Press on CAB ACTIVATE button. (MFD2, monitoring system, and key card reader turn on. Auxiliary compressor turns on if air pressure is too low.)

* 3) Verify maintenance events pages on MFD2 to ensure there is no SET maintenance events related to Friction Brakes, ATC/SS/ACSES, Alerter/Event Recorder, and Truck Surveillance. Notify supervisor if any SET maintenance event is present.

* 4) Select propulsion system status and check following status on both power cars:

- Red: MCB (Open)
- Gray: K-AUX-2 Contactor Open, HEP supplied from other power car regeneration, rheostatic, traction knockout, lockout, grounding switch, power knockout.
- Green: HEP On, Rectifiers (4), Choppers (4), MPUs (2), Inverters (3), Pantographs (2), ELD.

5) Apply key card against key card reader and enter valid PIN number.

6) Set reverser to Neutral to enable cab controls and turn on MFD1, POD, and ADU.

7) Verify there are no alarms indicated on Alarms section of MFD1.

8) Press on PANTO-UP pushbutton to raise rear pantograph of leading power car and front pantograph of trailing power car (Pantograph Local Selector set to AUTO).

9) Turn HEP switch to ON. Contactor K-AUX-2 closes to supply whole trainset with 480 V, and main air compressor starts (Main Reservoir pressure should reach at least 130 psi).

10) Wait until Main Reservoir pressure is above 125 psi.

11) On MFD2 (propulsion status), check that contactor K-AUX-2 is yellow (close) on trailing power car, and that MCB is green (close) on both power cars.

2.2.5.2 Brake Predeparture Test.

WARNING:

THE TRAINSET BRAKES ARE DISABLED FOR SOME OF THE STEPS IN THE BRAKE PREDEPARTURE TEST. PRIOR TO STARTING THE BRAKE TEST, ENSURE THE TRAINSET IS SECURED, WITH WHEEL CHOCKS IN PLACE. THE APPLICATION/RELEASE TEST TO CHECK PADS AND SHOES MUST BE PERFORMED BY TWO PERSONS.

(1) Select friction brakes subsystem status on MFD2.

(2) Ensure parking brake switch is in APPLY position, and verify that "Parking" indicators are yellow for all cars on MFD2.

(3) Set BRAKE VALVE C/O switch to OUT.

(4) Set ABCL to release (REL). (Equalizing Reservoir starts to charge.)

(5) Wait until Equalizing Reservoir pressure is above Brake Pipe pressure on MFD1.

(6) Set BRAKE VALVE C/O switch to PASS. (Brake Pipe begins to charge.)

(7) Set BRAKE VALVE C/O switch to OUT to ensure Brake Pipe is fully charged.

(8) Set BRAKE VALVE C/O switch to PASS. Repeat last two steps if Brake Pipe is not fully charged. (BP = 110 ± 2 psi on MFD1, BC = 0 psi for all cars on MFD2.)

2.2.5.2.1 Application/Release Test (To Check Pads and Shoes).

NOTE:

This test must be performed from the leading power car.

(1) Set ABCL to Full Service (FS). (BP = 81 ± 2 psi on MFD1.) Check if all vehicles respond on MFD2. (BC = 52 ± 4, power cars; BC = 56 ± 4, passenger cars.)

(2) Visually and or manually inspect that brake shoes and pads are firmly seated against the wheels or discs on all cars.

(3) Set ABCL to release (REL). (BP = 110 ± 2 psi on MFD1, BC = 0 psi for all cars on MFD2.)

(4) Set parking brake switch to RELEASE. (Parking indicators turn gray for all cars on MFD2.)

NOTE:

Every 25 seconds, reset the alerter alarm with the Acknowledge switch. (The yellow ALERTER indication disappears on POD.)

(5) Visually and or manually inspect that brake shoes and pads have sufficient clearance from the wheels or discs on all cars. (Brake applied indicators released (IN) on all cars.) Brake shoes total clearance: between 1/2" and 5/8". Brake pads total clearance: between 3/32" and 3/16".

(6) Set parking brake switch to APPLY. (Parking indicators turn yellow for all cars on MFD2.)

2.2.5.2.2 Application Test.

(1) Verify ABCL is in release (REL). (BP = 110 ± 2 psi on MFD1, BC = 0 psi for all cars on MFD2.)

(2) Move ABCL from REL to Minimum (MIN). (BP = 102 ± 2 psi on MFD1, BC = 18 ± 4 psi for all cars on MFD2.)

(3) Move ABCL from MIN to Suppression (SUP). (BP = 92 ± 2 psi on MFD1, BC = 44 ± 4 psi for all cars on MFD2.)

(4) Move ABCL from SUP to Full Service (FS). (BP = 81 ± 2 psi on MFD1, BC = 52 ± 4 psi for all cars on MFD2.)

2.2.5.2.3 Graduated Release Test.

(1) Move ABCL to increase BP pressure approximately 6 psi. (BP = 86 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

(2) Move ABCL from 86 psi to Suppression (SUP). (BP = 92 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

(3) Move ABCL from SUP to Minimum (MIN). (BP = 102 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

(4) Move ABCL from MIN to release (REL). (BP = 110 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

2.2.5.2.4 Interactive Brake Test.

STEP DESCRIPTION	MFD1 INDICATION
1) Press "Train Operation" button on MFD1.	No MFD1 indication required.
2) Press "Brakes Test" button.	No MFD1 indication required.
3) Confirm the detected configuration	Detected Configuration Number of Power Cars/Coaches Do you confirm? Yes, No
NOTE: Brake test procedure is enabled.	
4) Press "Initiate" button.	No MFD1 indication required.
NOTE: MFD1 initiates the test and displays step-by-step instructions in the "Test Procedure" section of the screen, as shown in the MFD1 INDICATION column.	
	Preparation for Test:
NOTE: In this brake test, the BRAKE VALVE C/O switch on the engineer's desk right switch panel must be placed in PASS. position.	
5) Set ABCL to release (REL) position.	Charge the system BP = 110 ± 2 psi (BC = 0 psi on MFD2)
NOTE:. For safety reasons, the parking brake must have been applied at the end of the Application/Release test.	
	Apply parking brake
6) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify brake pipe air leakage.	Tightness Check (BP Leakage Test)
7) Set ABCL position to SUP position to get a BP pressure reduction of 20 psi from released value, as displayed on BP pressure gauge.	Make 20 PSI BP reduct Brake Pipe drops to 92 ± 2 psi

STEP DESCRIPTION	MFD1 INDICATION
8) After 30 seconds, move BRAKE VALVE C/O switch to OUT position.	Cut out BP charging
9) Take a reading of the BP pressure and, with a stop watch, wait 3 minutes, and:	After 3 min: check BP reduct
NOTE: To comply with FRA standards, after one minute, the BP reduction should be less than (or equal to) 5 psi.	
10) Take a second reading.	BP reduct not exceed 9 PSI
11) Press Confirm/Next Step button.	Display next Brake Test steps.
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the service portion of the brake system.	Full Service Test
12) Move BRAKE VALVE C/O switch to PASS. position, then move ABCL to release (REL) position.	Cut In BP charge, Rel. brake BP = 110 ± 2 psi
13) After 30 seconds, move ABCL to full service position.	Put ABCL to full service BP = 81 ± 2 psi
14) Take a BC pressure reading on MFD2 to check if all vehicles respond.	Read the BC pressure
15) Power Cars: BC = 52 psi ± 4 psi. Coaches: BC = 56 ± 4 psi.	Chk if BC within tolerance
16) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the operation of the brake control computer.	Computer Mode Test
NOTE: The Pneumatic Control Magnet Valve (PCMV) is automatically energized in the Analog Converter position. ER and BP are reduced to 81 ± 2 psi.	
17) Place ABCL to release position.	Put ABCL in release
18) BP pressure should remain at 81 ± 2 psi.	Chk if BP remains at 81 psi
19) Press Confirm/Next Step button.	

STEP DESCRIPTION	MFD1 INDICATION
The next steps verify the emergency portion of the brake system.	Emergency Brake Test
20) Move ABCL to EMERGENCY position.	Put ABCL to emergency
21) Take a BP pressure reading on MFD1, and a BC pressure reading on MFD2.	Read the BP and BC pressure
22) BP pressure on MFD1 should be 0 psi.	Check if BP dropping to zero
23) BC pressures on MFD2 should be: Power Cars = 60 ± 4 psi. Coaches = 64 ± 4 psi.	Chk if BC within tolerance
24) Wait 60 seconds minimum, then move ABCL to release position.	After 60 S: ABCL to release BP starts to charge.
NOTE: BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	
25) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the emergency mushroom portion of the brake system.	EEPV Test
26) Press the engineer EMERGENCY BRAKE VALVE mushroom, or Engineer's Emergency Pushbutton Valve (EEPV).	Activate the EEPV
27) Take a BP pressure reading on MFD1, and a BC pressure reading on MFD2.	Read the BP and BC pressure
28) BP pressure on MFD1 should be 0 psi.	Check if BP dropping to zero
29) BC pressures on MFD2 should be: Power Cars = 60 ± 4 psi. Coaches = 64 ± 4 psi.	Chk if BC within tolerance
30) Wait 60 seconds Minimum, then reset the EMERGENCY BRAKE VALVE mushroom.	After 60 seconds: Reset EEPV
31) To charge the system, move ABCL to handle off, and then to release. BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	
32) Press Confirm/Next Step button.	

STEP DESCRIPTION	MFD1 INDICATION
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the emergency magnet valve operation.	EMV Test
NOTE: Wait until the Emergency Magnet Valve (EMV) is deenergized automatically by the computer, venting the BP.	
33) The brake control computer activates the emergency magnet valve automatically.	BCC activates EMV
34) BP pressure on MFD1 should be 0 psi. BC pressures on MFD2 should be: Power Cars = 60 ± 4 psi. Coaches = 64 ± 4 psi.	Chk if all vehicles respond
NOTE: The EMV is reset automatically by the computer.	
35) After 60 seconds, move ABCL to handle off, and then to release. BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	When ER is 0 put ABCL to HO
The next steps verify the pneumatic backup portion of the brake system.	Pneumatic Backup Test
NOTE: The Brake Control Computer deenergizes the Pneumatic Control Magnet Valve (PCMV) for pneumatic operation.	
36) Move ABCL to FULL SERVICE position.	Put ABCL to full service BP = 81 ± 2 psi, ER = 81 ± 2 psi
37) Take a BC pressure reading on MFD2.	Read the BC pressure
38) BC pressures on MFD2 should be: Power Cars = 52 ± 4 psi. Coaches = 56 ± 4 psi.	Chck if BC within tolerance
39) Move ABCL to release position.	Put ABCL to release
NOTE: BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	
40) BC pressures on MFD2 should be: Power Cars = 0 psi. Coaches = 0 psi.	Chck if BC within tolerance
NOTE: BP pressure = 110 PSI, BC pressure = 0 PSI.	

STEP DESCRIPTION	MFD1 INDICATION
41) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
NOTE: The brake control computer reenergizes the PCMV for normal operation.	
The next steps verify the electropneumatic portion of the brake system.	EP-Brake Test
BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	Put ABCL in release
NOTE: The ABCL is already in release.	
42) Move ABCL to full service position. Check if all vehicles respond on MFD2. After 4 seconds, BC pressure should be: Power Cars = 49 ± 4 psi Coaches = 53 ± 4 psi.	Put ABCL to full service BP = 81 ± 2 psi, ER = 81 ± 2 psi
43) Wait until brakes are applied and then move ABCL to release.	After 10 S: ABCL to release BP = 110 ± 2 psi.
44) With a stop watch, measure the time to fully release the brakes.	Note the release time
45) The release time should be within tolerances. After 5 seconds, BC pressure should be less than (or equal to) 5 psi.	Chk if rel time wt tolerance
46) Press Confirm/Next Step button.	Test Result: Passed
47) Press Print/Record button.	Print OK and Reprint buttons come on.
48) Press Print OK if the report is properly printed. Press Reprint is the report is not properly printed.	No MFD1 indication required.
49) Press Return button.	MFD1 screen displays the Train Operations page.

2.2.5.3 ATC Predeparture Test.

STEP DESCRIPTION	MFD1 INDICATION
NOTE: Next steps are preparation for ATC predeparture test	
1) Verify that ABCL is in release (REL) position.	
2) Set reverser to FORWARD position.	
3) Set effort lever to "0" position.	
4) Ensure that parking brake is applied.	Parking Brake: Applied
NOTE: All parking indicators should be yellow on MFD2.	
5) Ensure there is no code present in track. The Aspect Display Unit (ADU) should indicate restricting aspect (20 mph).	
6) Verify that there is no "Overspeed", "Suppression", and/or "Penalty Application" indications on the POD.	
7) Press ATC Test button.	Display menu choice.
NOTE: Next steps test the ATC in a step-by-step operation.	
8) Press Initiate button.	
The system goes through all aspects of the cab signal, increasing from 0 to 150 mph, and decreasing from 150 mph to 0. The system activates the alarm and displays all overspeed points.	The system will go through all aspects of the cab signal and display all overspeed points
Wait until the ADU display shows 150 mph ending the increasing cycle. Then, the POD displays 0 mph. Immediately after, the ADU shows 150 mph again to start the decreasing cycle.	Acknowledge all warnings except Restricted aspect
NOTE: Acknowledge only the warnings when the system is decreasing the cab signal speed, except the last one at 20 mph (restricting aspect).	

STEP DESCRIPTION	MFD1 INDICATION
9) Acknowledge all signal changes with the ACKNOWLEDGE switch (engineer's desk right switch panel) at: 125 mph 100 mph 80 mph 60 mph 45 mph (approach limited) 30 mph (approach medium) 30 mph (approach)	Alarm turns off when change of speed aspect is acknowledged.
10) Do not acknowledge 20 mph (restricting). Wait until the system automatically initiates a penalty brake application. The overspeed indication status flashes on the POD.	Overspeed indication flashes (after 5 sec.)
11) Five seconds after last downward code change, the ATC triggers a penalty brake.	Verify the brake pipe pressure drop. BP = 81 ± 2 psi.
12) Five seconds after last downward code change, the ATC triggers a penalty brake.	Application indication turns on (within 6 sec).
NOTE: The propulsion control unit turns on the "Penalty Application" on the POD to ensure that the power knockout interface is functional.	
13) Acknowledge to shut off the alarm.	
14) Set ABCL to suppression (SUP) position. Penalty application and overspeed indications turn off. Suppression indication (yellow) turns on.	BP = 92 ± 2 psi.
15) Set ABCL to release (REL) position. Suppression indication (yellow) turns off. BC = 0 psi for all cars on MFD2.	BP = 110 ± 2 psi.
16) Set the reverser to neutral.	
17) Press Confirm Result button.	Test Result: Passed
18) Press Print/Record button.	Display menu choices.
19) Press Print OK if report is properly printed.	Display menu choices.
20) Press Return button.	Display menu choices.

2.2.5.4 Alerter Predeparture Test.

WARNING:
ENSURE THE TRAINSET IS SECURED, WITH WHEEL CHOCKS IN PLACE.

STEP DESCRIPTION	MFD1 INDICATION
1) Verify that the ABCL is in release (REL) position. BC = 0 psi for all cars on MFD2.	BP = 110 ± 2 psi.
2) Release parking brake. Parking brake indicators turn gray on MFD2.	
3) Press Alerter Test button.	Start of Alerter test procedure enabled.
4) Press Initiate button.	Initiate test and display the step-by-step operation.
NOTE: If the ATC is cutout, the alerter cannot be acknowledged by the acknowledge footswitch and whisker switch. One of the other reset functions must be used.	
5) Wait approximately 25 seconds when audible alarm starts and reset the alerter using the ACKNOWLEDGE switch.	Reset the Alerter using various inputs
NOTE: In each case, the alerter yellow indication flashes on the POD and disappears after the acknowledgement.	
6) Wait another 25 seconds when audible alarm starts and reset the alerter by activating the bell.	Reset the Alerter using various inputs
7) Wait another 25 seconds when audible alarm starts and do not reset the alerter.	Do not acknowledge
NOTE: The POD alerter yellow indication comes on. The system automatically initiates a penalty brake application. The propulsion control unit turns on the "Penalty Application" on the POD to ensure that the power knockout interface is functional.	
8) Penalty brake should be initiated.	Verify the brake pipe pressure drop and Application indication BP = 81 ± 2 psi.
9) Set ABCL to suppression (SUP) position.	Reset Penalty with brake Suppression (BP = 92 ± 2 psi)
NOTE: The alerter yellow indication and the white penalty application indication disappear on the POD.	

STEP DESCRIPTION	MFD1 INDICATION
10) Set the parking brake to APPLY position. Parking brake indicators for all cars turn yellow on MFD2.	
11) Set ABCL to release (REL) position. BC = 0 psi for all cars on MFD2.	BP = 110 ± 2 psi
12) Press Confirm Result button.	Test Result: Passed
13) Press Print/Record button.	Display menu choices.
14) Press Print OK if the report is properly printed.	Display menu choices.
15) Press Return button.	Display menu choices.

2.2.5.5 ITSU Predeparture Test.

STEP DESCRIPTION	MFD1 INDICATION
1) Press ITSU Test button.	Display menu choice.
2) Press Initiate button.	1- Initiate the test.
This initiate an ITSU self test and in parallel opens the "on board" trainlines. (The operator should verify and acknowledge that the ONBOARD FAILURE indicator is ON.)	2- Acknowledge that on board light on the console is lit
NOTE: If the test result is passed, press the Confirm/next Car button to test the next car.	
3) Press Confirm/Next Car button.	3- Select the next car button.
4) Continue the sequence until the last car is checked.	4- Continue this sequence until last car.
5) Press the Confirm/next Car button to test the next car.	5- Press passed or failed button to confirm test result.
6) Press Print/Record button.	Display menu choices.
7) Press Print OK if the report is properly printed.	Display menu choices.
8) Press Return button.	Display menu choices.
9) Press Return button.	Return to the Main Operations Page of MFD1.

2.2.6 COUPLING (Fig. 2-94 and 2-95). Before coupling the power car, the shroud should be opened in accordance with the following procedure:

WARNING:

THE FOLLOWING PROCEDURES MUST BE RESPECTED TO OPEN AND CLOSE THE SHROUD. FOLLOW THE OPERATIONAL SEQUENCE INDICATED. TWO TRAINED PERSONS ARE REQUIRED TO OPEN OR CLOSE THE SHROUD. FAILURE TO DO SO MAY RESULT IN INJURY OR DAMAGE TO EQUIPMENT.

WARNING:

WHEN A LADDER HAS TO BE USED TO REACH THE LATCHES, MAKE SURE IT IS SECURED PROPERLY AND HELD IN PLACE BY ANOTHER PERSON. FAILURE TO DO SO MAY RESULT IN INJURY OR DAMAGE TO EQUIPMENT.

CAUTION:

The hood is spring- loaded. The headlight shroud should be fully closed and latched before opening the hood. Failure to do so may result in damage to equipment.

NOTE:

When opening the hood, a 1/3-turn counterclockwise on the compression latch releases the pressure and an additional 1/4-turn counterclockwise releases the pawl.

(1) Unlock five compression latches on hood with 5/16-in Allen key.

(2) Unlock four compression latches on side walls.

CAUTION:

The hood should lift by itself and exceed the shroud height by 1 3/4 in ± 1/4. If not, two persons should manually lift the hood to obtain the above measurement. Failure to do so may result in damage to equipment.

(3) Pull handle once to retract both flaps. Visually check both flaps. If not retracted, push them manually.

(4) Holding handle in open position, push shroud unlocking lever and lift shroud.

(5) When shroud latches in semi-opened position, release handle.

CAUTION:

Do not touch any latch or handle to fully open the shroud. Failure to do so may result in damage to shroud mechanism and finish.

(6) Push on shroud until it retracts above collision block. Make sure that shroud latches at end of travel.

(7) Using two quick-release pins, secure shroud in open position.

WARNING:

IF IT IS NOT POSSIBLE TO INSERT THE PINS, THE SHROUD IS NOT LATCHED PROPERLY AND SHOULD NOT BE LEFT IN THAT POSITION.

1. Compression Latch
2. Hood
3. Lateral Flap
4. Shroud
5. Handle
6. Shroud Unlocking Lever
7. Collision Block
8. Quick-Release Pin
9. Pin Receptacle
10. Retaining Pin
11. Release Handle
12. Headlight Shroud

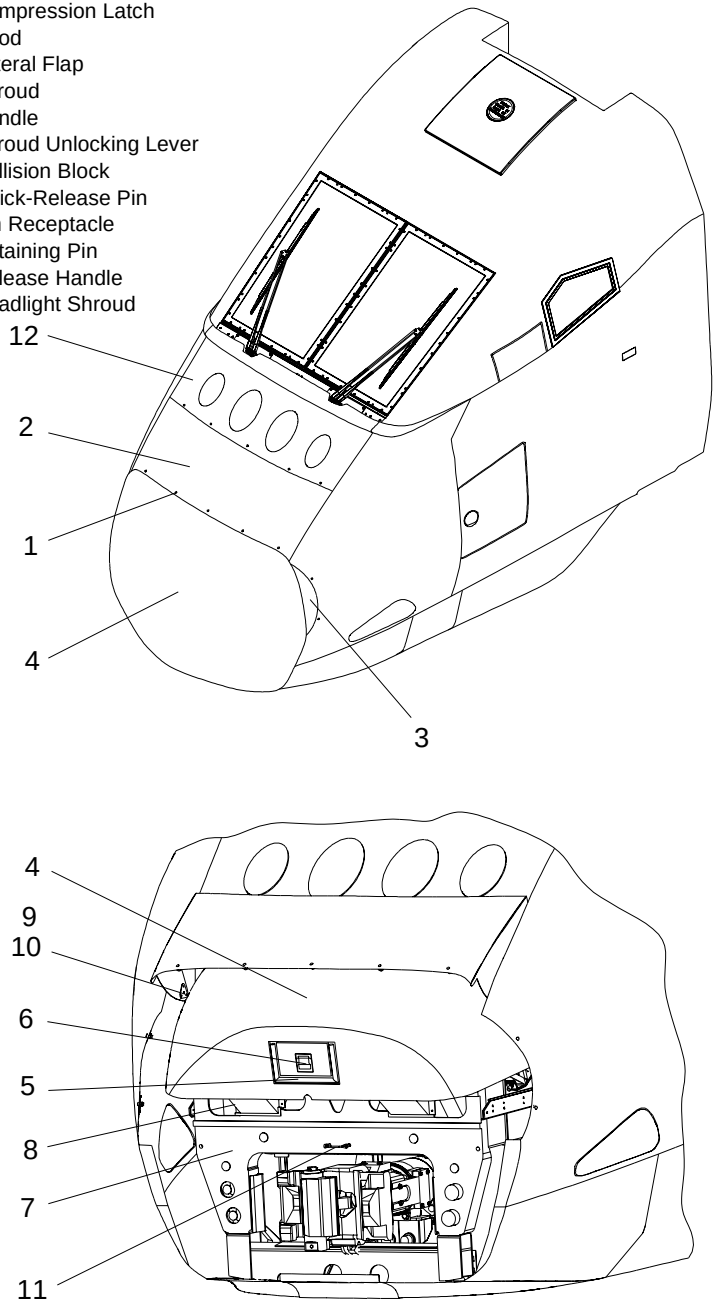


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Figure 2-94
Power Car Shroud

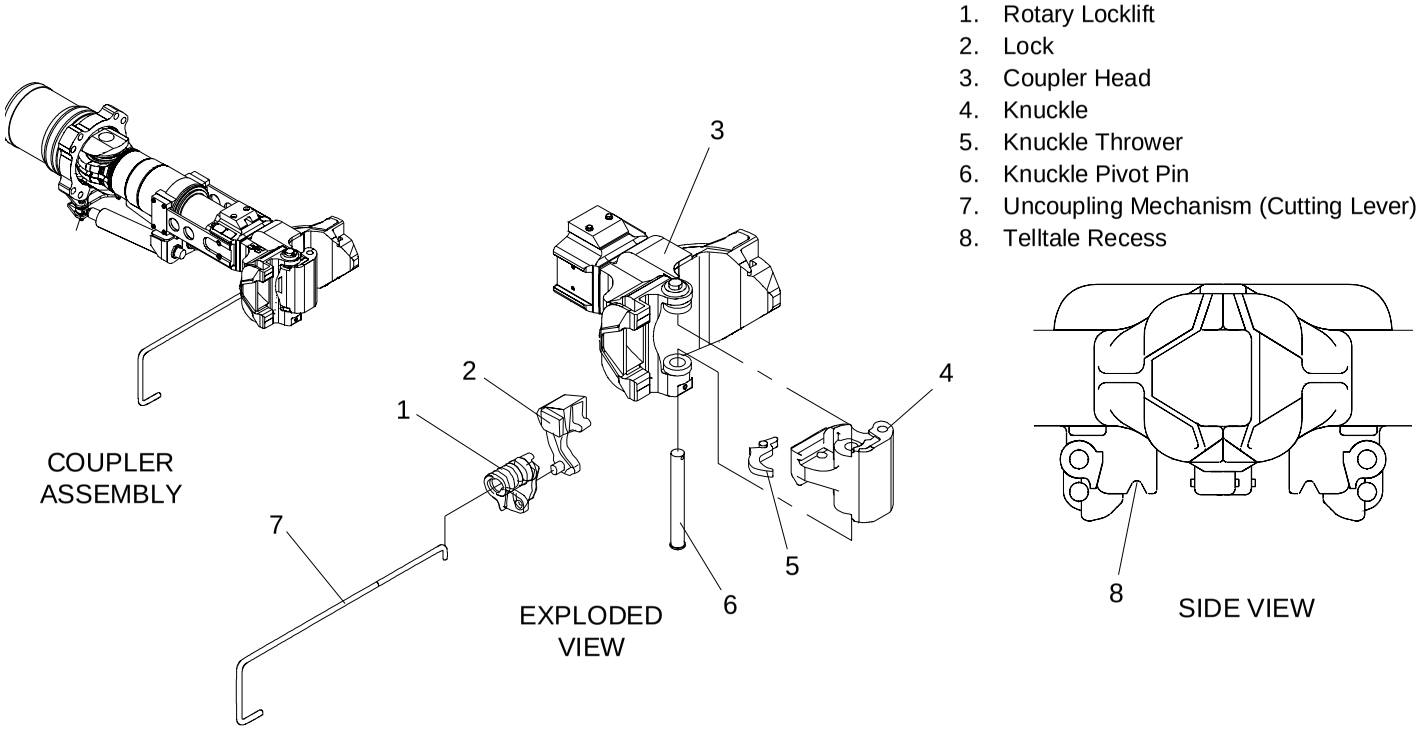


Figure 2-95
Properly Locked Coupler and Mechanical Head Exploded View

(8) Push hood down in order to align pin receptacles and insert both retaining pins.

WARNING:

DO NOT DRIVE THE POWER CAR WITH OPENED COUPLER SHROUD IF QUICK-RELEASE PINS ARE NOT INSERTED. FAILURE TO DO SO MAY RESULT IN INJURY OR DAMAGE TO EQUIPMENT.

To couple the power car to another car, proceed as follows:

NOTE:

One of the couplers must be in open position.

(1) Apply parking/hand brake on equipment to be coupled.

(2) Open a single knuckle of couplers to be mated by actuating coupler operating mechanism manually.

CAUTION:

Vehicle must coast into mating vehicle during coupling maneuver. Failure to do so may damage equipment.

(3) Couple at speed of 2.5 mph ± 1 mph.

CAUTION:

The speed limit must be adhered to in order to prevent damage to the equipment.

(4) Inspect telltale recess to determine if coupler is properly locked. (See Figure 2-95 "Properly Locked Coupler and Mechanical Head Exploded View.")

(5) Release parking/hand brake.

2.2.7 EN ROUTE PROCEDURES. This subsection describes the procedures that have to be performed en route by the train crew. The leading cab is defined as the first uncoupled cab with its reverser set to NEUTRAL, FORWARD, or REVERSE with the proper authorization. This automatically locks out all other cabs in the trainset.

2.2.7.1 Speedometer Check. To perform a speedometer check, proceed as follows on MFD1:

(1) Press Speed Check button.

(2) Press Start button on first milepost.

(3) Press Stop button on second milepost.

(4) Time taken between two mileposts is indicated in seconds on the screen.

NOTE:

To calculate the actual speed in miles per hour, divide 3600 by number of seconds.

(5) Press return button once to return to MFD1 main status screen.

2.2.7.2 ACSES Fault Alarm. Whenever this alarm appears on MFD1, proceed as follows:

- Cutout electrical portion of ACSES (ACSES equipment cabinet).
- If penalty still cannot be recovered, cutout ACSES penalty magnet valve (blue) on pneumatic brake control unit.
- Proceed as per operating rules.
- Notify dispatcher.

2.2.7.3 Alerter Fault Alarm. Whenever this alarm appears on MFD1, proceed as follows:

- If penalty cannot be recovered, cutout alerter penalty magnet valve (yellow) on pneumatic brake control unit.
- If audible alarm sounds continuously, break seal and cutout electrical portion of alerter (electrical locker No. 2).
- Proceed as per special instructions.
- Notify dispatcher.

2.2.7.4 ATS/ATC Fault Alarm. Whenever this alarm appears on MFD1, proceed as follows:

- Break seal and cutout electrical portion of ATS/ATC (ATSCO switch on ATC equipment cabinet).
- If penalty cannot be recovered, cutout ATS/ATC penalty magnet valve (red) on pneumatic brake control unit.
- Proceed as per operating rules.
- Notify dispatcher.

2.2.7.5 Battery Overtemp Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This is the battery protection system.

- Open battery main circuit breaker, CB50, near rear door left side (or with remote shunt trip above the side access doors).
- Notify dispatcher.
- Proceed.

2.2.7.6 Brake Control Fault Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

The pneumatic backup is automatically activated.

- Perform running brake test.
- If brakes respond, proceed.
- If brakes do not respond, apply emergency brake.
- Notify Dispatcher.

2.2.7.7 Car Not Centered Alarm (Fig. 2-96). For this alarm, the car number is indicated. Whenever the "Car not Centered" alarm is displayed for more than 2 seconds on the POD, the train must be stopped on a tangent track and the actual condition of the train must be verified as follows (see figure 2-96 "Car Not Centered Tool" for more details):

NOTE:

This alarm causes an onboard speed restriction (20 mph).

- On car to be verified, reach one side of a truck.
- Insert "MUST FIT" NO-GO gage around large nut attaching air bag seating to rotating bolster. If it does not fit, truck is considered not centered.
- Insert "MUST NOT FIT" NO-GO gage around large nut attaching air bag seating to rotating bolster. If it does fit, truck is considered not centered.
- If both gages do what they are intended to do, truck is considered centered.
- Repeat preceding steps for other truck. If both trucks are centered, car is considered centered.
- If car is considered centered, centering detection cutoff switch can be put in "cut-out". This cancels "Car not Centered" alarm indication on POD. Train operating speed is then limited to "Metroliner" speed which is 4.5" CD (see Column "A" speeds and schedule information on Amtrak Employees schedule).
- If car is considered not centered, train operating speed is limited to a maximum of 3" CD.

2.2.7.8 Conductor Valve Appl Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Identify car by checking brake system status page on MFD2.
- Reset valve.
- Notify dispatcher.
- Proceed.

2.2.7.9 Emergency Door Released Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm causes a loss of traction power.

- Stop trainset.
- Check door system status page on MFD2 to identify door location.
- Close emergency handle.
- Notify dispatcher.

2.2.7.10 EMI Limit Exceeded Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

The Main Circuit Breaker (MCB) is open.

- Close MCB.
- Proceed.

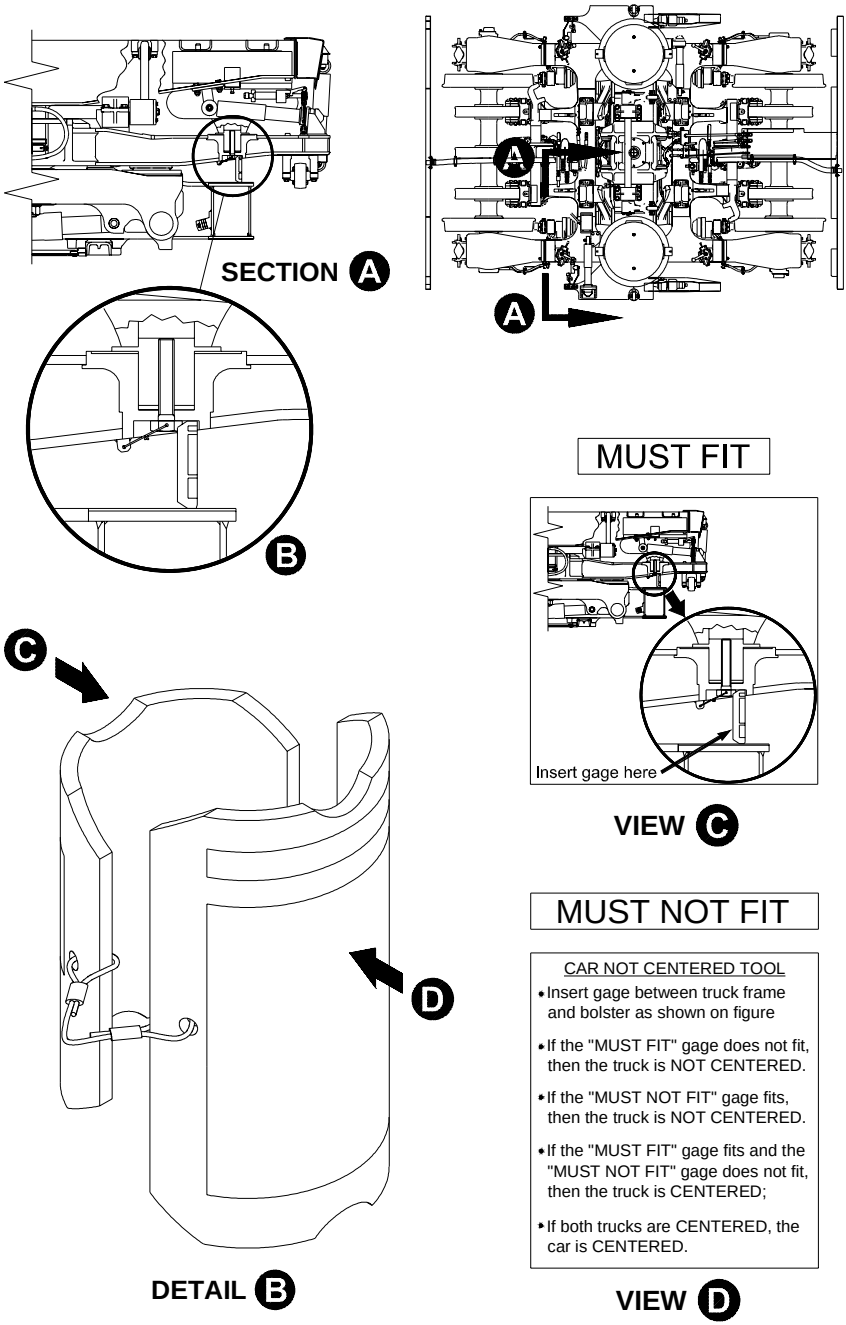


Figure 2-96
Car Not Centered Tool

2.2.7.11 Fire Detected Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Acknowledge with MFD1 or FIRE SUPP. INHIBIT pushbutton to inhibit automatic fire extinguishing.

NOTE:

Fire suppression is automatic after two minutes with no acknowledgment.

- Whenever the alarm is acknowledged, check in the equipment room.
- In case of fire, initiate manual fire suppression with the FIRE SUPP. ACTIVATION pushbutton.

2.2.7.12 Hot Journal Alarms. For this type of alarm, the affected wheel number and the car number are indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm causes an onboard speed restriction (20 mph).

- Stop trainset.
- Check journal temperature using templestick.
- When a hot journal (212 ^{o}) is confirmed, proceed as per special instructions.
- When a hot journal (212 ^{o}) is not confirmed, cutout defective sensor on ITSU (electrical locker No. 1).
- Notify dispatcher.

2.2.7.13 Locked Axle Alarms. For this type of alarm, the affected axle number and the car number are indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Activate truck brake equipment cutout cock on affected truck.
- Notify dispatcher.
- Proceed.

2.2.7.14 Low Transformer Oil Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Check oil level if possible. (If not, refer to maintenance personnel.)
- If level is appropriate, cutout defective sensor with bypass switch on propulsion electrical cubicle.
- Notify dispatcher.
- Proceed.
- If level is low, lower pantograph on faulty power car (with pantograph local selector on propulsion electrical cubicle).
- Notify dispatcher.
- Proceed (with reduced traction power).

2.2.7.15 Speed Sensing Fault Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Break seal and cutout electrical portion of speed sensing system (SSCO switch on ATC equipment cabinet).
- Proceed with reduced speed as per operating rules.
- Notify dispatcher.

2.2.7.16 Traction Still Applied Alarm. Whenever this alarm appears on MFD1, proceed as follows:

- In braking mode, check if traction is removed from both power cars.
- If traction is removed there is a sensor fault.
- Proceed.
- If traction is not removed in braking mode, there is a traction fault.
- Lower pantograph on faulty power car (with pantograph local selector on propulsion electrical cubicle).
- Notify dispatcher.
- Proceed (with reduced traction power).

2.2.7.17 Unknown Speed Restriction Alarm. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm causes an onboard speed restriction (20 mph).

- The alarm could be caused by:
  - Fire control unit
  - Tilting system
  - Integrated truck surveillance system.
- Identify responsible system by checking all appropriate subsystems status pages on MFD2.
- Proceed as per special instructions.
- Notify dispatcher.

2.2.7.18 Battery CB Open Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

Battery power is unavailable.

CAUTION:

A penalty brake application may occur upon MCB opening.

- When practical, close battery circuit breaker (CB50 next to rear door, left side).

2.2.7.19 Battery Chargers Flt Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

Battery chargers are not available. There is a maximum of 20 minutes of operating left.

- If the alarm affects the leading power car, try cycling battery circuit breaker CB50 (next to rear door, left side).
- If previous step fails, set up the trainset for operation from trailing end.
- If the alarm affects the trailing power car, try cycling battery circuit breaker CB50 (next to rear door, left side).
- If previous step fails, set up the trainset for single unit operation.
- Proceed to nearest station if possible.
- Notify dispatcher.

2.2.7.20 Brg Sensor Fault Alarms. For this type of alarm, the affected wheel number and the car number are indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm causes an onboard speed restriction (20 mph).

- Stop trainset.
- Check journal temperature using templestick.
- When a hot journal (212 º) is confirmed, proceed as per special instructions.
- When a hot journal (212 º) is not confirmed, cutout defective sensor on ITSU (electrical locker No. 1).
- Notify dispatcher.

2.2.7.21 Cannot Announce > 15% Loss Alarm. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm indicates a communication problem.

- Perform running brake test.
- If results are satisfactory, proceed.

2.2.7.22 Cat Voltage Below 8.4kv Alarm. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

The alarm is associated with an automatic traction power reduction.

- Proceed.

2.2.7.23 Cat Voltage Below 8.7kv Alarm. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

The alarm is associated with an automatic traction power reduction.

- Proceed.

- Notify dispatcher.

2.2.7.24 Cat Voltage Below 17.5kv Alarm. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

The alarm is associated with an automatic traction power reduction.

- Proceed.
- Notify dispatcher.

2.2.7.25 ELD Fault/Locked Out Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Lower pantograph on faulty power car.
- Proceed (with reduced traction power).
- Notify dispatcher.

2.2.7.26 Elect Brake Loss 50% Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed.
- Check MFD2 to view faults that affect electrical braking (propulsion subsystem status page).

2.2.7.27 Elect Brake Loss 100% Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed.
- Check MFD2 to view faults that affect electrical braking (propulsion subsystem status page).

2.2.7.28 Event Recorder Fault Alarm. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

No corrective action possible. The electrical cutout on the alerter/recorder control unit in electrical locker No. 2 cuts out the alerter portion only.

- Notify dispatcher.

2.2.7.29 HEP Fault Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Notify dispatcher.
- Check MFD2 to view the faults that affect the electrical braking (propulsion subsystem status page).

2.2.7.30 Incoming Train Order Alarm. Whenever this alarm appears on MFD1, proceed as follows:

- Acknowledge alarm.
- Confirm printout is OK.
- Proceed as per special instructions.

2.2.7.31 Load Shed Level 2 Flt Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm is generated in the power car when the battery load shed level 2 is lost while the level 1 load shed is still present. It is also generated when circuit breaker CB81, Monitoring Input/Output, is open (turned off).

NOTE:

If the fault is in a trailing power car, it could cause the loss of the marker lights and other equipment.

- Reset any tripped circuit breaker.
- If the alarm is still present, notify dispatcher.

2.2.7.32 Loss Of >15% Friction Brake Alarm. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed in accordance with railroad operating rules and instructions.

2.2.7.33 Main CB Locked Out Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm indicates a repetitive MCB fault.

- If there is no traction, ensure that other power car MCB is closed.
- Proceed (with reduced traction power).
- Notify dispatcher.

2.2.7.34 No Wheel Slip Protect Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Activate both truck brake equipment cutout cock in the affected car.
- Notify dispatcher.

2.2.7.35 Panto F Broken Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Ensure pantograph is down.
- Perform visual inspection.
- Cutout pantograph air supply (pantograph pneumatic control panel).
- Set pantograph local selector switch to REAR.
- Raise rear pantograph.
- Notify dispatcher.
- Proceed.

2.2.7.36 Panto F Too High Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed.

2.2.7.37 Panto R Broken Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Ensure pantograph is down.
- Perform visual inspection.
- Cutout pantograph air supply (pantograph pneumatic control panel).
- Set pantograph local selector switch to FRONT.
- Raise front pantograph.
- Notify dispatcher.
- Proceed.

2.2.7.38 Panto R Too High Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed.

2.2.7.39 Tilting Fault. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

All cars are automatically centered.

- Proceed as per special instructions.

2.2.7.40 Traction Loss 50% Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed.
- Notify dispatcher.
- Check MFD2 to view faults that affect propulsion system.

2.2.7.41 Traction Loss 100% Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Proceed.
- Notify dispatcher.
- Check MFD2 to view faults that affect propulsion system.

2.2.7.42 Truck Hunt Fault Alarms. For this type of alarm, the affected truck location (A-End, B-End, F-End, or R-End) and the car number are indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm causes an onboard speed restriction (20 mph) until the defective sensor is bypassed.

- Proceed as per special instructions.

2.2.7.43 Truck Hunting Alarms. For this type of alarm, the affected truck location (A-End, B-End, F-End, or R-End) and the car number are indicated. Whenever this alarm appears on MFD1, proceed as follows:

- Reduce speed in 5 mph increments until truck hunting stops.

- Resume normal speed when fault clears.
- Notify Dispatcher of track location.

2.2.7.44 Truck Surveil Fault Alarm. For this alarm, the car number is indicated. Whenever this alarm appears on MFD1, proceed as follows:

NOTE:

This alarm causes an onboard speed restriction (20 mph) until the ITSU is bypassed.

- Proceed as per special instructions.

2.2.7.45 Degraded ITSU Operation. The degraded operation is only used in case of sensor failure. To bypass the defective sensor, press simultaneously on the ITSU SELF TEST and LAMP TEST buttons. The ALARM SENSOR indicator changes from flashing to steady illumination, and the LOCAL ALARM ACKNOWLEDGMENT indicator turns on. In case of multiple sensor failures, one activation of the degraded mode bypasses each defective sensor.

NOTE:

The degraded mode remains active until the system is shut down and restarted. The sensor failure remains as long as the defective sensor is not replaced.

2.2.7.46 ITSS Cutout. In case of ITSS failure, bypass system with ITSU CUTOUT switch. Break seal and lift hinged cover to access switch. With system bypassed, onboard failure trainline is reenergized.

2.2.7.47 Tilting System Operation. Enable and/or disable the tilting system for the whole trainset with the TILTING switch. Push the switch in ENABLE position to rearm the tilting system.

WARNING:

IN NORMAL OPERATION, THE TILTING SYSTEM IS CONTROLLED BY THE ACSES SYSTEM. IF THE TRAINSET IS OPERATED WITHOUT A FUNCTIONAL ACSES SYSTEM, STRICT ADHERENCE TO THE PROCEDURE OF DISABLING THE TILTING SYSTEM IN NONTILT ZONES MUST BE FOLLOWED TO AVOID THE RISKS OF EXCEEDING THE DYNAMIC CLEARANCE.

In case of malfunction in any passenger car, use its centering detection cutoff switch to cut off the car centering detection system.

2.2.7.48 Power Car Lighting System Operation. To operate the lighting system, use switches as indicated below:

(1) Headlights: Set HEADLIGHT switch on engineer's desk right switch panel to DIM or FULL position to control headlights intensity.

(2) Marker Lights: An automatic control activates the power car marker lights when the cab is activated.

(3) Ditch Lights: Ditch light operation depends on manipulation of DITCH LIGHT switch (engineer's desk right switch panel):

- With switch in AUTO position, blow horn to make ditch lights flash alternately. Press on BELL button on engineer's desk right switch panel to turn off.

- Set switch to FLASH position to make ditch lights flash alternately.
- Set switch to ON position to turn on ditch lights.

NOTE:

Ditch lights operate only when headlights are on.

(4) Cab Ceiling Lights: Set CAB CEILING LIGHT switch on engineer's left switch panel to ON position to turn on cab ceiling lights.

NOTE:

Set switch to EXIT position to turn on access lights for one minute.

(5) Timetable and Console Lights: Set TIMETABLE switches on engineer's left switch panel and assistant's left switch panel to ON position to turn on their respective timetable lights. Adjust lighting intensity with CONSOLE DIMMER switch on engineer's left switch panel.

(6) Walkway Lights: Set WALKWAY LIGHT switch on cab rear wall switch panel to alternate position to turn on walkway lights

(7) Maintenance Lights: Set MAINTENANCE LIGHT switch on cab rear wall switch panel to ON position to turn on maintenance lights.

2.2.7.49 Passenger Car Lighting System Operation. Adjust intensity of aisle lights and ceiling panel lights in passenger areas with DIMMER CONTROL switch of lighting control unit.

2.2.7.50 Side Doors Operation. Control side doors operation from leading power car cab by using switches on engineer's right switch panel as indicated below:

- Use DOOR OPEN INHIBIT switch on engineer's right switch panel to prevent side doors opening.
- Use DOORS CLOSED AND LOCKED switch to bypass a wrong "doors closed and locked" signal in case of loss of traction power.
- Use NO-MOTION BYPASS switch to bypass a wrong motion signal from speed sensing system that prevents operation of side doors.

2.2.7.51 Side Doors Opening. Open any local side door from inside or outside by placing crew key switch in the OPEN position.

To control side doors opening from any car in a train, activate any DCS (with a standard coach key) on proper side of train and use its pushbuttons as indicated below.

NOTE:

DCS ACTIVE indicator turns on to show that DCS controls the associated doors. (Only one DCS can be active at any time on one side of the train.)

(1) Check that HEALTHY indicator is on, and DOOR OPEN INHIBIT indicator off.

(2) Press on LOCAL OPEN pushbutton to open local side door.

NOTE:

Forward and rearward OPEN pushbuttons are now active.

(3) Press on forward OPEN pushbutton to open all doors in that direction.

(4) Press on rearward OPEN pushbutton to open all doors in that direction.

(5) Press on rearward and/or forward ENABLE pushbutton to allow door opening with PASSENGER OPEN pushbutton in selected direction.

NOTE:

ENABLE indicators turn on to indicate direction in which door opening is authorized.

2.2.7.52 Side Doors Closing. Close and lock any local side door from inside or outside by setting crew key switch to CLOSE position.

To control side doors closing from any car in train, activate (with a standard coach key) any DCS on proper train side and use its pushbuttons as indicated below.

NOTE:

DCS ACTIVE indicator turns on to show that the DCS controls associated doors. (Only one DCS can be active at any time on one side of the train.)

(1) Check that HEALTHY indicator is on.

(2) Press on forward CLOSE pushbutton to close all doors in that direction.

(3) Press on rearward CLOSE pushbutton within 0.5 second to close all doors in that direction.

NOTE:

An audible tone sounds. A verbal announcement is made at all doors before they close.

(4) Press on LOCAL CLOSE pushbutton to close local side door.

NOTE:

An audible tone sounds before the door closes.

2.2.7.53 Collision Post and Body End Doors Operation. Place interior door mode selector switch to required position as indicated below.

- Place selector in Automatic position for automatic door operation.
- Place selector in Open position to leave door open until another mode of operation is selected.
- Place selector in Manual position to remove all power from doors. This allows manual door operation.

NOTE:

Door open pushbutton enable manual door opening when infrared sensor fails.

2.2.7.54 Power Car HVAC System Operation. To operate power car HVAC system, use switches on engineer's center console switch panel as indicated below:

- Set A/C switch to AUTO position to enable cab air conditioning.
- Set CAB HEATER switch to HEAT position to enable cab heating.
- Adjust cab temperature from 65 °F to 75 °F with CAB °F temperature selector.
- Set WINDSHIELD HEAT switch to ON position to activate windshield heating, only when the exterior temperature requires it.

- Set DEFROST switch to FAN position to blow air onto windshield, and to HEAT to ensure that air is heated, only when exterior temperature requires it.

2.2.7.55 Fresh Air Dampers Operation. Whenever required, such as when in a tunnel in proximity to a diesel engine, close all trainset fresh air dampers with FRESH AIR DAMPERS switch on engineer's overhead switch panel. Automatic damper control is reestablished after one hour.

2.2.7.56 Passenger Car HVAC System Operation. To adjust car temperature in passenger areas, use temperature control switch settings as follows:

- NORMAL, to maintain car temperature as per normal setting.
- LOW, to maintain car temperature as per normal setting minus 3 ^{o}F.
- HIGH, to maintain car temperature as per normal setting plus 3 ^{o}F.
- LAYOVER, to maintain car temperature above 45 ^{o}F.

Place any emergency blower fan switch in CUT-OUT position to cut out 120 Vac power to the blower fans.

NOTE:

Both switches have to be set to NORMAL position to restart the fans.

2.2.7.57 Engineer Communication Systems Operation. Proceed as follows:

(1) Select proper mode of operation with button on remote control head.

(2) In radio mode, select a channel by pressing on CHAN button and appropriate keys on numeric keypad.

(3) Talk in headset, or

(4) Press and hold down the communication footswitch and use microphone in center of console.

2.2.7.58 Assistant Communication Systems Operation. Proceed as follows:

(1) Verify if proper mode LED on assistant's headset station is lit.

(2) If not, press MODE button and select proper mode of communication.

(3) Talk in headset, or

(4) Press and hold down PTT button and use microphone.

2.2.7.59 Cafe Car Radio Operation. Proceed as follows:

NOTE:

Use low power two way radio for communication with trainset handheld radios. Use high power two way radio for communication with wayside radios.

(1) Verify if proper mode LED on radio is lit.

(2) If not, press MODE button on radio and select proper mode of communication.

(3) Press and hold down PTT button on radio and use radio microphone.

2.2.7.60 Communication Station Operation. Proceed as follows:

(1) Verify if proper mode LED on communication station is lit.

(2) If not, press MODE button and select proper mode of communication.

(3) Press and hold down PTT button on assistant's headset station and use microphone.

2.2.7.61 Emergency Rescue Station Operation. In case of emergency, use outside emergency rescue station to transmit a public address announcement to the trainset interior speakers.

2.2.7.62 Attendant Call. Whenever an attendant call button has been pressed, check call location on attendant call annunciation panel or bulkhead display sign. After attending call, reset annunciation panel by pulling up attendant call button.

2.2.7.63 General Information Display. Change the information displayed on the general information display by selecting the appropriate message from the crew office MFDB.

2.2.7.64 Automatic Brake Operation. To initiate a service brake, move ABCL from REL into a brake position.

To increase brake effort, push ABCL towards FULL position.

To reduce brake effort, pull ABCL towards REL position.

2.2.7.65 Recovery from a Penalty Brake Application. Proceed as follows:

(1) Move ABCL to SUP position.

(2) As soon as penalty condition has been satisfied, return ABCL to REL position.

(3) Return throttle to 0 position.

2.2.7.66 Degraded Propulsion Operation. If key card reader bypass switch is set to bypass position while throttle is in a power position, no power is applied to traction motors unless throttle is cycled from 0 to a power position.

2.2.7.67 ATS/ATC Alarm. When in coded territory, and ATS/ATC alarm sounds, proceed as follows:

NOTE:

When starting to move, acknowledge all audible alarms from the system within 5 seconds.

(1) Acknowledge change in aspects within 5 seconds, or achieve permanent suppression.

NOTE:

Change to a more restrictive aspect must be acknowledged even when the train is stopped in a station.

(2) If penalty brake application occurs, perform running recovery. (Refer to Subsection 2.2.7.72, on page 2-161, "Running Recovery after Penalty Brake Application".)

2.2.7.68 Overspeed Alarm. When change of code or excessive speed causes alarm and overspeed indication, proceed as follows:

(1) Initiate permanent suppression (ABCL in SUPP position) within 5 seconds.

(2) Achieve permanent suppression (steady SUPPRESSION indication), or reduce speed below limit within 5 seconds.

NOTE:

Alarm sounds and overspeed indicator flashes in case of penalty brake application.

(3) Move ABCL to SUPP position to shut off alarm.

(4) To recover from penalty brake application, perform running recovery when underspeed. (Refer to Subsection 2.2.7.72, on page 2-161, "Running Recovery after Penalty Brake Application".)

NOTE:

If overspeed condition is caused by more restrictive change of code, acknowledge code change within initial 5 seconds.

2.2.7.69 Requiring Acknowledgment Function. While moving under restricting aspect and after all ATS/ATC conditions have been satisfied, the requiring acknowledgment function of the system is in operation. In this case, an alarm is received as soon as the train starts moving. The engineer must acknowledge the alarm within 5 seconds. Once the alarm is acknowledged, there is no more alarm.

2.2.7.70 Non-Cab Signaled Territory Operation. To operate in non-cab signal territory, reduce speed to below 20 mph, and set CAB TERRITORY switch (cab rear wall switch panel) to OUT. This allows operation with overspeed point of 79 mph until valid track code is received. System ignores OUT position of switch unless train speed is below 20 mph and all ATS/ATC operational requirements are met.

This mode is intended for use in non-cab signal territory. General rules for this mode are as follows:

(1) Upon entering non-cab signal territory, and restricting aspect on ADU is illuminated, and with speed less than or equal to 20 mph, when engineer sets CAB TERRITORY switch to OUT position.

(2) The acknowledge alarm is silent.

(3) Speed is restricted to 79 mph.

2.2.7.71 Enforced Cut-In. If a valid code rate is detected, the alarm sounds. Set CAB TERRITORY switch on the cab rear wall switch panel to IN position and acknowledge alarm within 5 seconds to avoid an irretrievable train stop penalty brake application.

2.2.7.72 Running Recovery after Penalty Brake Application. To perform running recovery of penalty brake application from the automatic train control system, proceed as follows:

(1) Acknowledge alarm.

(2) Move ABCL to SUPP position.

(3) Move throttle to 0.

(4) Release brakes.

2.2.7.73 Alerter Timing Reset. To reset alerter timing, either use ACKNOWLEDGE switch on engineer's desk right switch panel, or acknowledge footswitch, or use one of the following resets:

- Activate horn (with pushbutton or footswitch),
- Activate bell,
- Change throttle position,
- Change ABCL position.

2.2.7.74 Alerter Sleep Mode. To enter sleep mode operation, train must be stopped and brakes applied, or ABCL must be in HO position with no active cab. System automatically switches back to normal operation if status of those two conditions change.

Another sleep mode set of conditions are:

(1) Automatic brake application of suppression or greater.

(2) Parking brake application

(3) Cab deactivated, with ABCL in HO position and no active cab.

In sleep mode, alerter functions of the system are disabled. However events are still logged in memory. Access to PCMCIA interface is available for downloading events by maintenance personnel.

2.2.7.75 Alerter Cutout. When failure in system results in penalty brake application, proceed as follows:

(1) Break seal on alerter cutout switch and place it in cutout position. (See figure 2-45 for exact location.)

NOTE:

Alerter cutout energizes penalty magnet valve using alerter event recorder circuit breaker, CB61. If circuit breaker cannot energize Alerter/Recorder Control Unit (ARU), alerter cutout is not effective.

(2) If cutout is ineffective, use alerter sealed cutout cock (yellow) on pneumatic brake control unit. (See figure 2-39 for exact location.)

2.2.8 HIGH VOLTAGE POWER - TURNING OFF AND ON (Fig. 2-97). Whenever access to the roof, or to the central or auxiliary block, is required, proceed as follows:

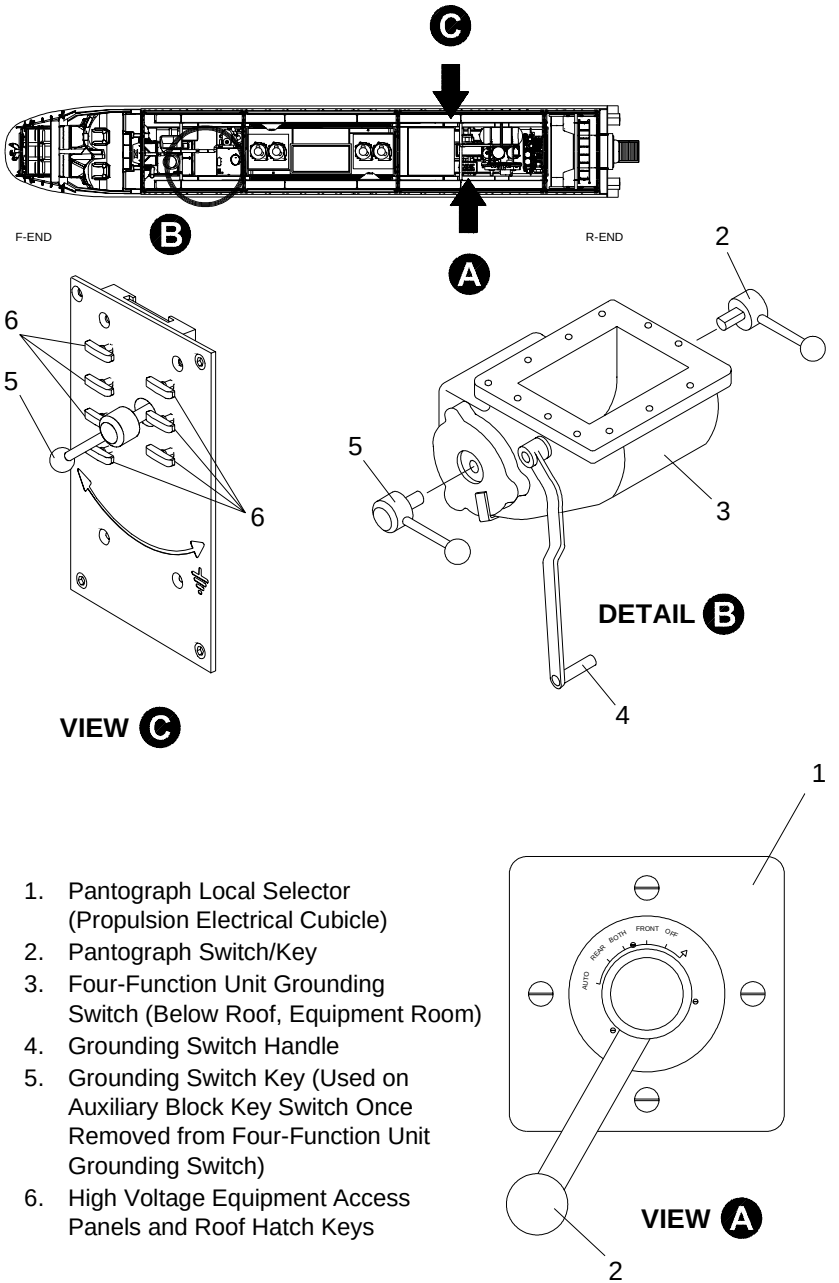
NOTE:

The procedure removes all high voltage power from the equipment.

2.2.8.1 Grounding Switch Key. The grounding switch key is used to unlock the roof hatch and to gain access to the electrical components of the central block and auxiliary block. Proceed as follows:

(1) Set pantograph switch/key, on Pantograph Local Selector (PLS) of propulsion electrical cubicle, to OFF in order to:

- Deenergize the magnet valve
- Vent the cylinder
- Open the Main Circuit Breaker (MCB).



1. Pantograph Local Selector (Propulsion Electrical Cubicle)
2. Pantograph Switch/Key
3. Four-Function Unit Grounding Switch (Below Roof, Equipment Room)
4. Grounding Switch Handle
5. Grounding Switch Key (Used on Auxiliary Block Key Switch Once Removed from Four-Function Unit Grounding Switch)
6. High Voltage Equipment Access Panels and Roof Hatch Keys

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Figure 2-97
High Voltage Power Removal Keys

(2) Turn pantograph switch/key clockwise (another tenth of a turn beyond OFF) and remove it.

(3) Insert pantograph switch/key into keyway at back of four-function unit grounding switch in equipment room, below roof; then push and turn a quarter-turn upwards (clockwise).

(4) Pull down handle in front of four-function unit. This grounds both sides of Main Circuit Breaker (MCB) and both sides of main transformer primary.

(5) Push grounding switch key, in front of four-function unit, and turn key a quarter-turn down (clockwise).

(6) Remove grounding switch key.

2.2.8.2 Access to the Equipment. To gain access to electrical components of the central block and auxiliary block, and to open the roof access hatch, perform the following procedure:

WARNING:

ONLY THE QUALIFIED MAINTENANCE PERSONNEL SHOULD ACCESS THE ROOF AND THE ELECTRICAL COMPONENTS OF THE CENTRAL BLOCK AND AUXILIARY BLOCK.

WARNING:

HIGH VOLTAGE, IN THE 2750 VDC RANGE, IS PRESENT ON THE DC-LINK. BEFORE SERVICING UNIT, ENSURE POWER IS OFF. FAILURE TO DO SO MAY RESULT IN INJURY OR DEATH.

(1) Make sure that all LEDs of the LED display above auxiliary block key switch are off. These LEDs, when illuminated, indicate the presence of 2750 Vdc on the dc-Link.

(2) Insert grounding switch key into auxiliary block key switch, and turn counterclockwise to grounding position. This unlocks seven keys that are used to open the access panels to the equipment in the central and auxiliary blocks, or the roof access hatch.

WARNING:

HIGH VOLTAGES ARE PRESENT ON THE POWER CAR ROOF. TO PREVENT INJURY OR DEATH FROM ELECTRICAL SHOCK, ALWAYS EXERCISE EXTREME CARE WHEN ACCESSING THE ROOF.

NOTE:

To access the roof, in addition to the unlock interlock of the hatch, a bar in the middle of the roof opening has to be moved. This action mechanically locks down both pantographs.

2.2.8.3 Reestablishing High Voltage Power. To reestablish high voltage power, follow these steps:

NOTE:

Make sure that all the seven keys are in place in the auxiliary block key switch.

(1) Turn grounding switch key, in auxiliary block key switch, clockwise to normal operating position. This locks the central and auxiliary block panels.

(2) Remove grounding switch key.

(3) Insert grounding switch key, into keyway in front of four-function unit, and turn key a quarter-turn counterclockwise (up).

(4) Pull up handle, in front of four-function unit. This removes ground from both sides of the MCB, as well as input side of main transformer primary.

(5) Turn pantograph switch/key, at back of four-function unit grounding switch, a quarter turn counterclockwise (downwards).

(6) Remove pantograph switch/key.

(7) Insert pantograph switch/key into pantograph local selector keyway, slightly to right of OFF position, and move it back to OFF.

2.2.9 TAKING A SIDE DOOR OUT-OF-SERVICE. To take a side door out-of-service, proceed as follows:

WARNING:

THE DOOR WILL SLAM IF THE AIR PRESSURE IS ON WHEN THE OUT-OF SERVICE LOCK IS USED.

(1) Shut off air pressure.

(2) Manually close and lock door.

(3) Rotate out-of-service lock 270^{o} with key.

(4) Restore air pressure (if possible).

If the emergency handle is activated when the door is out-of-service, proceed as follows:

(1) Shut off air pressure.

(2) Reset emergency handle.

(3) Manually rotate out-of-service lock cams until latch is vertical (normal mode).

(4) Manually close and lock door.

(5) Rotate out-of-service lock 270^{o} with key.

(6) Restore air pressure (if possible).

2.2.10 END OF TRIP PROCEDURES. This subsection describes the procedures to perform before a trainset is put out of service and/or to change ends.

2.2.10.1 Changing Ends. To change ends, proceed as indicated in the following subsections.

2.2.10.1.1 Cab To Cut Out. Proceed as follows:

(1) Set ABCL to FULL position.

(2) Set BRAKE VALVE C/O switch on Engineer's desk right switch panel to OUT position to cut off brake pipe charging.

(3) Verify brake pipe pressure is maintained at 85 psi.

(4) Set ABCL to HO Position.

(5) Set reverser to OFF position to deactivate cab makeup circuit.

2.2.10.1.2 Cab To Be Energized. Proceed as follows:

(1) Activate cab. (Refer to Subsection 2.2.2, on page 2-126, "Preparation for Operation".)

(2) Set reverser to N, FWD, or REV.

(3) Move ABCL to FULL position until equalizing reservoir reaches 85 psi.

(4) Set BRAKE VALVE C/O switch on Engineer's desk right switch panel to PASS. (passenger cars) to cut in brake pipe charging.

NOTE:

BP should remain at 85 psi.

2.2.10.1.3 Cab Deauthorization. To deauthorize cab, proceed as follows:

(1) Apply key card against key card reader.

(2) Dial "0,0,0,0" before leaving cab.

NOTE:

If trainset is running, and a speed is detected, system does not allow deauthorization of last highest level existing in system.

- Setting reverser to OFF automatically cancels all authorization levels previously entered. This automatic deauthorization occurs 10 seconds following reverser setting to OFF.
- All authorization levels are also nullified whenever train dc power is shut down.

NOTE:

It is the responsibility of the users to authorize and deauthorize their access to the propulsion and monitoring systems.

2.2.10.2 Cab Deactivation. There are two scenarios of cab deactivation: trainset left powered from the catenary or shop supply, and trainset without any external power.

NOTE:

Cab deactivation does not disable the propulsion inverters, MPUs, pantograph operation, and does not change their configuration.

2.2.10.2.1 With High Voltage Supplied. To deactivate cab, set reverser to OFF. This deauthorizes all levels after 10 seconds. This condition extinguishes POD, MFD1, and indicators located on the console; MFD2 turns off after 10 seconds.

2.2.10.2.2 Without External Power. Trainset dc power shutdown sequence is automatic. If high voltage from pantograph, or 480 Vac from shop supply is lost, and if reverser is set to OFF, complete load shedding occurs after 15 minutes. This

condition removes all dc loads from battery. If reverser is left in N, FWD, or REV, load shedding occurs in two stages. Stage 1 removes part of loads, and occurs after 15 minutes. Stage 2 removes remaining dc loads, and occurs when battery decreases below “end of cell” voltage, or after reverser is set to OFF. Only one power car dc circuit remains powered from battery after complete dc power shut down. This circuit includes step lighting, ceiling lighting in equipment room, and cab activate circuit.

2.2.10.3 Access Lighting. To turn on access lights (ground lights, and all incandescent lights near door entrances, and in cab ceiling), set CAB CEILING LIGHT switch on engineer’s left switch panel to EXIT position. Access lights go out after one minute.

2.2.10.4 Layover Preparation. For a layover, proceed as follows:

- Turn momentarily PARKING BRAKE switch on Engineer’s right switch panel to APPLY position.
- Set CAB HEATER switch on Engineer’s center console switch panel to LAYOVER position to maintain temperature above 45^{o} F.

2.2.10.5 Water and Waste Retention Systems Operation. The following subsections describe the operation of the trainset water and waste retention systems.

(1) Toilet Flush Cycle

The toilet operational cycle can be summarized as follows:

- Time 0.0 Second: The toilet flush cycle is initiated by pushing the flush button.
- TIME 0.5 to 0.7 Second: The bowl is rinsed with 7 to 8 ounces of water.
- Time 1.0 to 1.5 Seconds: The toilet flush valve opens for 3.0 to 3.5 seconds, allowing the waste and water to be drawn into the waste tank.

(2) Reset Switch

The reset switch activates all the waste tank status panel indicators. This function is done directly within the waste tank status panel.

(3) Sewage Draining System Operation

Two drain valves are provided for waste tank draining on each side of the power car, under the skirts.

Rinse water is supplied by a separate connection from an external nonpotable water supply. The waste tank incorporates automatic vent and rinse.

The water connections are made on either side of the power car. Pipes from each water connector are joined near the waste tank with check valves to prevent cross flow. The check valves are connected to tank internal rinse through two solenoid valves connected in series. The arrangement is especially made to prevent freezing.

When either drain valves are open, the waste tank status panel valve open indicator is activated. It inhibits the air ejector solenoid valve, switches off 120 Vac to the toilet, and energizes the tank vent and rinse solenoids.

Turning either valve station to DRAIN position causes several operations to take place simultaneously:

- Associated drain valve opens.
- Air ejector and toilet operation is disabled.
- Vent valve opens, venting tank to allow rapid draining.
- Rinse valves open, rinsing complete interior of tank.

If the waste tank is full, the tank level measuring system inhibits tank rinsing and venting until the liquid level drops a few inches and the tank FULL light is deactivated. A manual vent valve is provided so that drainage of the tank is possible when power under 72 Vdc is present.

2.2.10.6 Defects Reports (Fig. 2-78 to 2-81). This subsection describes how to report defects by using the manual fault entry feature of MFD2. Proceed as follows:

(1) Press on Manual Faults button of the main operation page.

(2) Press on Car button of the manual fault entry page to select which car is affected.

(3) To record the car, press on the appropriate button of the car manual fault entry page, as follows:

- Press on Previous or Next buttons to specify the car by scrolling through the list at the top of the screen.
- Press on Select button, once the exact car is recorded.

(4) Press on Location button of the manual fault entry page.

(5) To record the location, press on the appropriate button of the location in car manual fault entry page, as follows:

- Press on Left/Right button to record side
- Press on Car End button to record end
- Press Digit 1 Up and Digit 2 Up buttons to record seat number.
- Press on left or right arrow buttons to specify location by scrolling through list at top of screen.
- Press on Select button, once exact location is recorded.

(6) Press on Equipment button of manual fault entry page.

(7) To record equipment, press on Page Up and/or Page Down button of equipment type manual fault entry page to select proper page for defective equipment. Then, press on Left or Right or Up or Down buttons to specify equipment by scrolling through list.

(8) Press on Select button, once proper equipment is recorded.

(9) Press on Fault Type button of manual fault entry page.

(10) To record fault type, press on appropriate arrow button of fault type manual fault entry page to specify fault type by scrolling through list.

(11) Press on Log Event button of manual fault entry page.

NOTE:

The event is then logged in the target car CMU and can be viewed like any other electronically detected fault.

(12) Press on Return button of manual fault entry page to return to main operation page.

2.2.10.7 Uncoupling (Fig. 2-94 and 2-95). The following procedure is applicable for the power cars. Uncoupling can only be done manually. Turn telescopic lever to uncoupling position. After equipment separation, the open coupler is ready to be coupled again.

(1) Set parking brake/handbrake on equipment to be separated.

(2) Ensure enough slack is provided to couplers.

(3) From right side of coupler head (when standing in cab, looking forward over coupler), actuate coupler uncoupling mechanism.

(4) Coupler is unlocked when a complete rotation of lock lift is achieved, and knuckle opens slightly to maintain locking pin in up position.

(5) Move power car away from equipment with parking brake/handbrake set.

After uncoupling, closing the shroud should be done following this procedure:

(1) Remove hood retaining pins and store them in their receptacles.

(2) Remove shroud security pins and store them in their receptacles.

(3) Pull handle on collision block and hold it while pulling shroud back towards you.

(4) Support shroud until it lowers to its semiclosed position.

(5) Pull handle firmly and then release paddle latch.

(6) Support shroud until it is almost closed; then, release it to latch by its own weight.

(7) Push hood down and rotate five spring latches.

(8) Reach into flap access and push up slam latch in order to close flap. Lock two spring latches. Repeat process on other side.

2.2.11 RECORDER DOWNLOAD PROCEDURES. There are two procedures that can be used to download data from the recorder. Before performing any download, ensure that all safety regulations have been adhered to.

To download data, the alerter/recorder must be in sleep mode (one of the following conditions must be met):

- Trainset stopped, with brakes applied;
- Automatic Brake Control Lever in Suppression or higher;
- No active cab, with Automatic Brake Control Lever in Handle Off position;
- Alerter Cut-Out switch in cutout position.

2.2.11.1 Downloading Recorder Data with a PCMCIA Card. To download data from the recorder, use a PCMCIA memory card with a capacity of 512Kb to 4Mb, and proceed as follows:

(1) Insert card into corresponding PCMCIA slot on Alerter/Recorder. (Ensure card is securely seated in place.)

(2) Press Download Button. (Yellow Download LED comes on.)

NOTE:

In normal condition, the LED stays lit for the entire download process, which should last eight (8) minutes or more depending on the capacity of the memory used.

(3) Once yellow Download LED turns off (to indicate download completed), remove PCMCIA card from Alerter/Recorder.

NOTE:

The data downloaded into the PCMCIA card can be transferred to the PTE by inserting the card into the PCMCIA slot of the PTE.

2.2.11.2 Downloading Recorder Data with the PTE (Lap Top). The data from the recorder can also be downloaded by using the PTE. Proceed as follows:

(1) Connect PTE to RS232 port (identified PTE) on Alerter/Recorder.

(2) Start PTE and launch Alerter/Recorder software. (Popup window appears on screen, initiating communication with the Alerter/Recorder.

(3) From Menu Bar, place pointer on TRANSFER drop down menu button.

(4) Locate and select DOWNLOAD EVENTS. (Popup window appears, prompting type of download required.)

NOTE:

Two choices are available: Full or partial download. A partial download is based on the starting date of the events required to be downloaded. This function can only be accomplished with the PTE.

(5) Once choice is made, select OK to confirm.

NOTE:

Another window appears to prompt a filename and location to download the data. A full download takes approximately 30 minutes to execute.

SECTION 2.3
EMERGENCY PROCEDURES

WARNING:

WHENEVER AN INDIVIDUAL HIGH-SPEED TRAINSET CAR HAS TO BE CONNECTED TO ANY OTHER EQUIPMENT, AS IN A YARD MOVE, BOTH THE BRAKE PIPE AND THE MAIN RESERVOIR NEED TO BE CONNECTED TO PROVIDE FUNCTIONAL BRAKES.

This section describes the procedures to be performed during emergencies by the trainset crew.

See figures 2-98 and 2-99 for the exact location of all the trainset emergency equipment and cutout cocks.

2.3.1 FIRE DETECTED - ALARM HANDLING. In case of fire in the central block or auxiliary block, the engineer can respond in the following manner:

(1) Allow the automatic fire suppression system to activate, which occurs after a two minute delay from initial alarm.

(2) Acknowledge the alarm and deactivate fire suppression, after confirming no fire exist, with the MFD1, or the FIRE SUPP. INHIBIT pushbutton.

NOTE:

Once the fire suppression system has been deactivated, the fire control unit (FCU) must be reset to get back the detection mode.

(3) Manually activate the fire suppression system, after confirming a fire exists, with the FIRE SUPP. ACTIVATION pushbutton.

The fire control unit bypass switch, on the propulsion electrical cubicle, is used to bypass the fire suppression system when it triggers a false fire alarm. It must be used only when it is confirmed that no fire exists.

WARNING:

THE AUTOMATIC FIRE SUPPRESSION SYSTEM IS DEACTIVATED WHEN THE FIRE CONTROL UNIT IS BYPASSED.

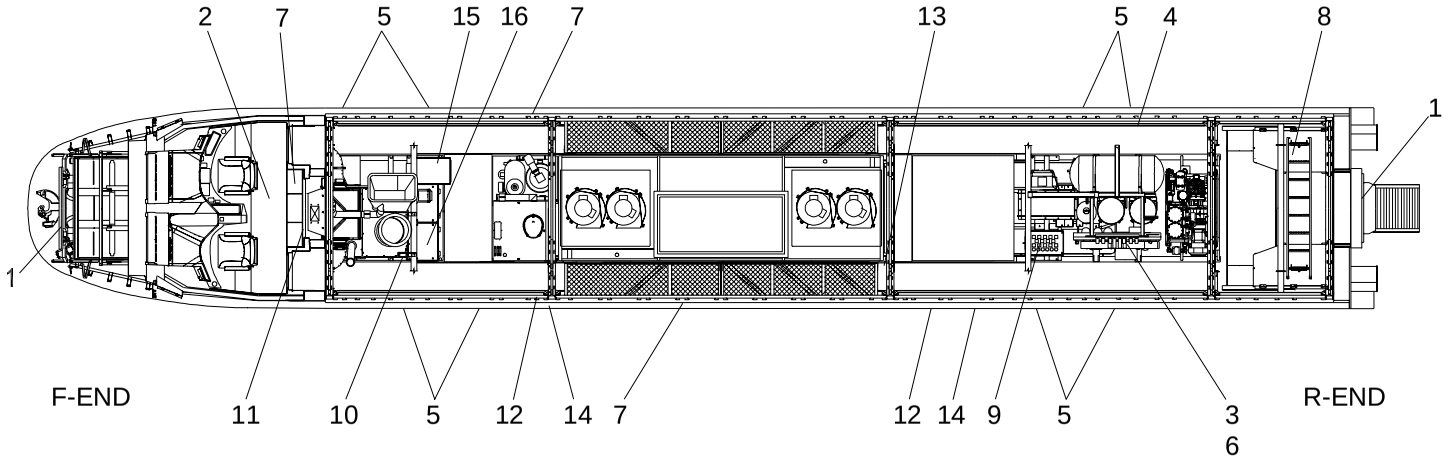
2.3.2 FIRE EXTINGUISHER OPERATION. Refer to instructions on the fire extinguisher label for operation.

2.3.3 EMERGENCY TOOLS. In the power car, a tool box is located on the cab wall. It contains an adjustable 12-inch wrench, a pinch bar, a special tool to open the shroud flaps, and a first aid kit.

In the passenger cars, the emergency equipment is located in the electrical locker, on the right side at the A-End.

2.3.4 FIRST AID EQUIPMENT. In the power car, a first aid kit is located in the tool box on the cab wall.

In the passenger cars, the first aid kit is located in the electrical locker, on the right side at the A-End. Another kit is located inside the crew locker in the cafe car crew office.



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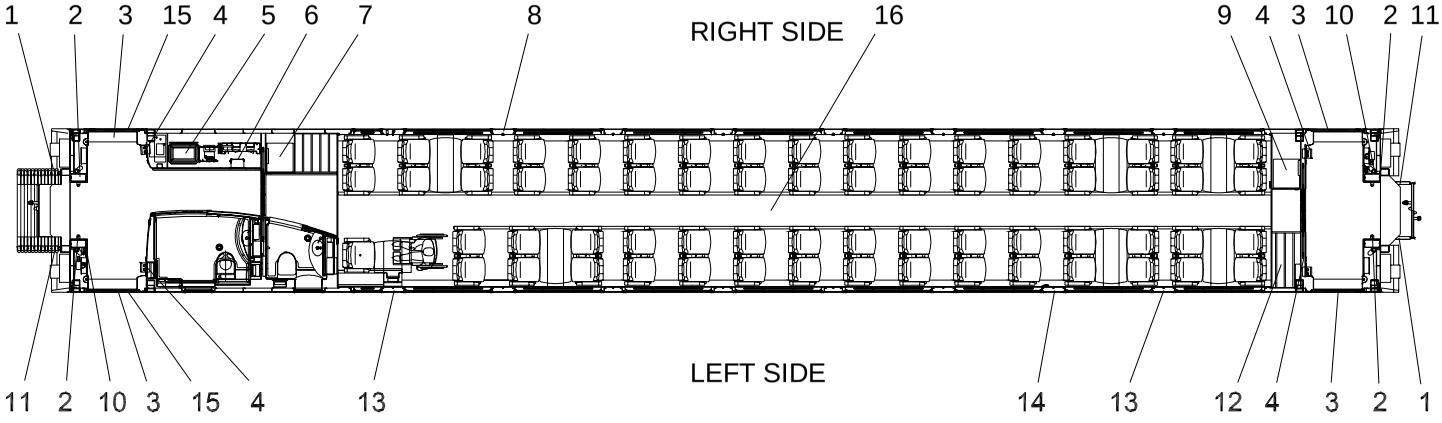
1. Pneumatic Cutout Cocks
2. Soft Spot for Emergency Access by the Exterior
3. Brake Control Unit, with Penalty Magnet Valves Cutout Cocks
4. Conductor's Emergency Brake Valve, and Emergency Magnet Valve Cutout Cock
5. Parking Brake Manual Override Levers
6. Pantograph Pneumatic Control Panel Cutout Handles
7. Fire Extinguisher
8. Roof Access Ladder
9. Propulsion Electrical Cubicle, with Key Card Reader, Pantograph Local Control, Oil Level Detector, Fire Control Unit Bypass Switches
10. ATSCO, SSCO, and ACSES Cutout Switches
11. Emergency Tools, with First Aid Kit
12. Interior Brake Cutout Cocks
13. Pantograph Pole
14. Exterior Truck Brake Cutout Cocks
15. Electrical Locker No. 2 with ARU Cutout Switch
16. Electrical Locker No. 1 with ITSU Cutout Switch

Figure 2-98
Emergency Equipment and Cutout Cocks Location - Power Car



1. Main Reservoir Pipe Cutout Cock
2. Exit Sign
3. Side Door, with Emergency Ground Light
4. Emergency Door Release Handle
5. Electrical Locker, with ITSU Cutout Switch
6. Emergency Equipment (Fire Extinguisher, First Aid Kit, Pinch Bar)
7. A-End Interior Truck Equipment Cutout Cock (All Passenger Cars)
8. Emergency Window (All Windows)
9. B-End Interior Truck Equipment Cutout Cock (CO, EC, FC)
10. Foldable Ladder
11. Brake Pipe Cutout Cock
12. B-End Interior Truck Equipment Cutout Cock (CA)
13. Exterior Truck Equipment Cutout Cock
14. Brake Control Unit, with Friction Brake System Cutout Cocks
15. Stepladder (EC, FC)
16. Soft Spot for Emergency Access by the Exterior

AB100006

Figure 2-99
Emergency Equipment and Cutout Cocks Location - Passenger Cars

2.3.5 OPENING WINDOWS IN AN EMERGENCY. All trainset windows are emergency windows that can be opened from the inside and the outside.

2.3.5.1 Opening a window from the Interior. To open any window in an emergency, proceed as follows from the interior of the car:

(1) Locate "red" handle on window and pull handle towards you.

(2) Use "red" handle to strip away rubber molding.

(3) Locate handle on window and pull handle towards you to remove the window panel.

2.3.5.2 Opening a window from the Exterior. To open any window in emergency, proceed as follows from the exterior of the car:

NOTE:

The procedure is detailed on a label affixed to the car exterior.

(1) Insert a screwdriver in red notch between rubber window seal and car body (as shown in cross-section inset). Pry down and outward to remove window seal.

(2) Using hands, remove entire rubber window seal by pulling up and outward.

(3) Pry window pane outward with screwdriver.

WARNING:

WINDOW WEIGHS 60 POUNDS.

2.3.6 EMERGENCY DOOR OPERATION. In an emergency, the side doors can be isolated or open. The procedures are described in the following sections.

2.3.6.1 Opening a Side Door. To open a side door in an emergency, proceed as follows:

(1) Break cover (for interior release, open emergency release panel).

WARNING:

USE A BLUNT INSTRUMENT TO BREAK THE COVER, NOT THE BARE HAND.

(2) Pull release lever out to its fully extended position. Lever stays in extended position. Door lock is unlocked.

(3) Open door manually using recessed handhold provided.

NOTE:

The lever only retracts to the closed position if the finger latch on the side of the lever is pressed. When the lever is retracted, the door closes (unless a door open command has been given).

2.3.6.2 Isolating a Side Door. There are two ways of isolating a side door in an emergency.

- Operate out-of-service switch. This locks the door in closed position and removes all power to door.

  (1) Ensure that door is in fully closed position and open panel at side of door.

(2) Using the crew key, rotate out-of-service switch fully clockwise ensuring that it stops in second position.

(3) Check that door is locked in place.

- Isolate DCS. Door is not isolated from power supply, but DCS is bypassed by trainlines.

(1) Insert key in DCS at DCS key switch position.

(2) Turn key to ISOLATE position

(3) Check that DCS ACTIVE indicator is not illuminated. Remove key without turning it from ISOLATE position.

- Operate pneumatic isolator. This isolates door from pneumatic supply.

2.3.6.3 Opening a Body End Door and a Collision Post Door.

Select the position required at the Mode Selector switch:

- DOOR OPEN - Doors remain open.
- MANUAL - Electrical and pneumatic power are removed. Doors open manually.

2.3.6.4 Isolating Body End Door and a Collision Post Door. The doors can be isolated in two different ways:

(1) Set switch to MANUAL position at mode selector switch.

(2) Set pneumatic door isolator to closed position (90 degrees to the direction of the tubing).

2.3.7 EMERGENCY BRAKING. The following subsections describe the emergency and penalty brake sequences of operation, and detail a recovery procedure for each event.

2.3.7.1 Emergency Brake Application. An emergency brake can be initiated by any one of the four methods described in following subsections.

2.3.7.1.1 Automatic Brake Control Lever. Proceed as follows:

(1) Move ABCL to EM position.

(2) Return ABCL to EM position until stopped.

(3) Set Effort Control Lever to 0 position.

2.3.7.1.2 Emergency Brake Valve. Proceed as follows:

(1) Push EMERGENCY BRAKE VALVE button on engineer's left switch panel or assistant's left switch panel.

(2) Leave valve open until stopped.

(3) Do not attempt to release brakes until stopped.

(4) Move ABCL to EM position.

(5) Set Effort Control Lever to 0 position.

2.3.7.1.3 Emergency Conductor's Valve. Proceed as follows:

(1) Pull valve handle in equipment room. Valve latches in activated position.

(2) Do not attempt to release brakes until stopped.

(3) Move ABCL to EM position.

(4) Set Effort Control Lever to 0 position.

2.3.7.1.4 Parting of Consist or Brake Pipe Rupture. Proceed as follows:

NOTE:

A separation or rupture causes a venting of brake pipe at emergency rate, applying emergency brake cylinder pressure.

(1) Do not attempt to release brakes until stopped.

(2) Move ABCL to EM position.

(3) Set Effort Control Lever to 0 position.

2.3.7.2 Emergency Brake Recovery. The following subsections describe how to recover from any case of emergency brake application.

2.3.7.2.1 Automatic Brake Control Lever. Proceed as follows:

(1) Move ABCL to HO position after stopping.

(2) Return master controller to 0 position.

(3) Perform required inspections as per Amtrak operating rules and instructions.

(4) Move ABCL to FULL SERVICE position to recharge brake pipe.

(5) Perform required air brake tests in accordance with AMT-3.

2.3.7.2.2 Emergency Brake Valve. Proceed as follows:

(1) Verify that ABCL is in HO position after stopping.

(2) Return master controller to 0 position.

(3) Reset emergency pushbutton valve.

(4) Perform required inspections as per Amtrak operating rules and instructions.

(5) Move ABCL to FULL SERVICE position to recharge brake pipe.

(6) Perform required air brake tests in accordance with AMT-3.

2.3.7.2.3 Emergency Conductor's Valve. Proceed as follows:

(1) Verify that ABCL is in HO position after stopping.

(2) Return master controller to 0 position.

(3) Reset applicable valve.

(4) Perform required inspections as per Amtrak operating rules and instructions.

(5) Move ABCL to FULL SERVICE position to recharge brake pipe.

(6) Perform required air brake tests in accordance with AMT-3.

2.3.7.2.4 Break-in-Two. Proceed as follows:

(1) Verify that ABCL is in HO position after stopping.

(2) Return master controller to 0 position.

(3) Reset applicable valve.

(4) Perform required inspections as per Amtrak operating rules and instructions.

(5) Move ABCL to FULL SERVICE position to recharge brake pipe.

(6) Perform required air brake tests in accordance with AMT-3.

2.3.8 DEAD ENGINE FEATURE. The trainset can be towed with a locomotive equipped with 26L brake equipment for rescue purposes using Dead Engine feature. This allows brake pipe air to fill main reservoir and brake controls of towed equipment, giving pneumatic control of friction brake.

WARNING:

WHENEVER AN INDIVIDUAL HIGH-SPEED TRAINSET CAR HAS TO BE CONNECTED TO ANY OTHER EQUIPMENT, AS IN A YARD MOVE, BOTH THE BRAKE PIPE AND THE MAIN RESERVOIR NEED TO BE CONNECTED TO PROVIDE FUNCTIONAL BRAKES.

WARNING:

A FALSE PARKING BRAKE APPLY INDICATION CAN OCCUR IF THE PARKING BRAKE IS APPLIED (USING THE PARKING BRAKE SWITCH ON THE ENGINEER'S RIGHT SWITCH PANEL OR THE PARKING BRAKE CUTOUT COCK ON THE BRAKE CONTROL UNIT) AND THE TRUCK MOUNTED PARKING BRAKE MANUAL OVERRIDE LEVER IS PULLED.

2.3.9 TOWING SETUP. For any towing operation, proceed as follows:

NOTE:

Perform required air brake tests in accordance with AMT-3.

(1) Apply parking brake, verify indication on MFD1 and confirm with outside gold indicators.

(2) If parking brake does not apply, activate parking brake impulse valve on pneumatic brake control unit, and reverify. (See figure 2-39 "Power Car Pneumatic Brake Control Unit" and figure 2-40 "Passenger Car Pneumatic Brake Control Unit - Typical" for exact location.)

(3) Press on PANTO-DOWN pushbutton.

(4) Set Automatic Brake Control Lever (ABCL) to full service in active cab.

(5) Set BRAKE VALVE C/O switch to OUT position in both cabs.

(6) Set ABCL to handle off position in both cabs.

(7) Set reverser to OFF position in both cabs.

(8) Connect and cut in BP trainline to towing locomotive.

(9) Connect and cut in MR trainline to towing locomotive.

(10) Verify that all truck brake equipment cutout cocks are in cut in position.

(11) Verify that Emergency Magnet Valve Cutout Cock (EMVCC) is closed (lever horizontal).

NOTE:

This prevents any unrequested emergency brake application.

(12) Perform application and release from towing locomotive. Verify that all cars respond.

(13) Release parking brake, verify indication on MFD1 and confirm with outside gold indicators.

(14) If parking brake does not release, activate parking brake impulse valve on pneumatic brake control unit, and reverify. (See figure 2-39 "Power Car Pneumatic Brake Control Unit" and figure 2-40 "Passenger Car Pneumatic Brake Control Unit - Typical" for exact location.)

(15) Move locomotive and perform a brake application. Verify consist responds.

(16) Once consist reaches its destination, apply the parking brake on the trainset.

(17) Isolate (cut out) MR and BP trainlines from towing locomotive.

(18) Return EMVCC to open position (lever vertical).

2.3.10 TRAINSET EVACUATION EQUIPMENT (Fig. 2-98 and 2-99). The following subsections detail the equipment used for the evacuation of the high-speed trainset. See Figures 2-98 and 2-99 for the exact location of the equipment.

2.3.10.1 Foldable Ladder. All passenger cars are equipped with foldable ladders located in each vestibule, next to the side door. The function of the ladder is to assist passengers in exiting the cars quickly.

The foldable ladder(s) is (are) stored in a locker beside the collision posts. In an emergency situation, the passengers can get access to the foldable ladders without the use of a key by pulling on a handle to open the locker access door.

Each foldable ladder is equipped with mounting hooks that maintain the ladder in position and prevent the side doors from closing on a passenger. The hooks can be inserted in the anchor points located on the outer side sill.

NOTE:

A decal highlights the foldable ladders location and provides all the required instructions concerning their use.

2.3.10.2 Stepladder. There are two stepladders in each trainset, one in each vehicle adjacent to a power car (end coach car and first class car). The stepladder provides a stable lightweight walkway that incorporates a grab handle for evacuation in nonemergency situations. Each stepladder is stored in an undercar compartment located at the A-End of the car. Access to the stepladder is gained from both sides of the trainset by unlatching the side skirt compartment.

The stepladder is equipped with mounting hooks that maintain the stepladders in position and prevent the side doors from closing on a passenger.

NOTE:

An appropriate decal highlights the location of the stepladder and provides all the required instructions concerning its use.

2.3.10.3 Emergency Windows. The emergency windows provide an emergency escape route when the doorways are obstructed, or when the car is derailed and resting on its side.

All the car side windows are emergency windows and are clearly identified as such. The windows sections can be removed by pulling off the lock strip and by using the handle to pull the window section out of the sash (from inside the vehicle only).

2.3.10.4 Soft Spot. There is a soft spot on the roof of each car. On the power car, it is located on top of the cab area. In all passenger cars, it is located at the center of the roof. The function of the soft spot is to enable an emergency rescue team to locate and cut through the carbody in order to reach the passengers inside. The soft spot location is highlighted with an appropriate decal.

2.3.10.5 Floor Lighting. The floor lighting guides the passengers towards the exits when the visibility is low. The lighting is directional and constantly illuminated.

2.3.10.6 Emergency Lighting. The emergency lighting provides lighting in the passenger area, in the vestibule and at the ground level. These lights are powered by the car battery when the HEP is not available. The emergency ground lights turn on when the side doors are opened.

2.3.10.7 Pinch Bar. The pinch bar is to be used by the passengers to exit the car when the door does not operate properly. The pinch bar is located in the toolbox near the electrical locker (identified as emergency equipment on Figure 2-99). It is accessed by pulling on the front panel. An appropriate decal highlights the location of the toolbox.

2.3.11 EMERGENCY EVACUATION. An emergency evacuation is a situation where time is crucial for passenger safety. It requires a rapid evacuation of the trainset. In this case, the crew members give their instructions over the PA system (if possible), and passenger egress is available from all doorways and emergency windows. Emergency lighting is maintained and passengers can follow the directional floor lighting leading to the nearest door. Interior doors may be opened automatically (if all systems are operational) or manually, by pulling the doors apart.

There are two distinct cases of emergency evacuation: trainset remaining on the track, or one or more cars derailed and resting on their sides.

2.3.11.1 Trainset Remaining on the Track.

2.3.11.1.1 Along the Right of Way. The procedures are identical for low platform, superelevated tracks, and open fields emergency evacuations.

The side doors can be opened with the interior or exterior emergency release handles. Before exiting the car, crew members or passengers retrieve the ladders located in each vestibule and put them in place at the doorways selected by the train crew. The ladder installation angle varies with the elevation. Passengers may also egress using the emergency windows by pulling on the emergency handle and removing the window section from its frame.

2.3.11.1.2 Tunnels. The emergency evacuation procedures described in the previous subsection also apply to all tunnel types, except the E. & N. River Lines tunnels. In these cases, no external safety devices can be used due to the small clearance between the tunnel wall and the carbody. Egress is accomplished using

the doors selected by the crew and the emergency windows on the side allowing the most clearance. Passengers can then climb onto the platform with the assistance of crew members.

2.3.11.1.3 Bridges . In case of emergency evacuation on a bridge, the crew members or passengers can retrieve the foldable ladders located in each vestibule. The angle at which the stepladders or ladders can be installed varies depending on the proximity of the edge of the bridge. Egress is accomplished using all crew selected doors and emergency windows on the side allowing the most clearance and safety.

2.3.11.1.4 Power Car. The crew members in the power car can egress using different means, depending on the type of emergency:

- They can egress through a side door of the power car and down the exterior ladder.
- They can also walk across the equipment room, through the door at the rear end, and disembark using the side door of the vehicle adjacent to the power car.
- If the equipment room is inaccessible, the crew members can egress through the side emergency windows.
- Finally, emergency personnel can retrieve crew members by cutting through the soft spot located on the roof of the power car and highlighted by a decal.

2.3.11.2 Derailment (Car on its Side). When a passenger car is resting on its side, the emergency evacuation can be done in different manners:

- Emergency personnel can release and manually open the exterior side doors from outside the car, by using only their common tools. (This is applicable if no damage affects the door, door frame, or operating mechanism.)
- Passengers can climb up through the side doors using the ladders located in each vestibule.
- If the side doors are inaccessible due to structural deformations, passengers can egress the trainset through the emergency windows by pulling on the emergency handle and removing the window section from its frame. (The weight of each window section is estimated at 70 pounds.)
- Finally, emergency personnel can retrieve passengers and crew members by cutting through the soft spot located on the roof at the center of each car and highlighted by a decal.

2.3.12 UNSCHEDULED STOPS. In an unscheduled stop, after a full stop and a PA announcement by crew members, passenger egress is accomplished in an orderly and controlled manner. The passengers carry their luggage and follow the directional floor lighting leading to the nearest end coach car or first class car side door. The interior doors may be opened automatically or manually.

In this type of egress, time is not a crucial variable for passenger safety. Passenger egress is available from both sides and at both ends of the trainset. However, there are scenarios where passenger egress for unscheduled stops must be accomplished using crew selected doors due to external physical constraints as, for example tunnels and bridges.

2.3.12.1 Along the Right of Way. The egress procedure and safety devices employed are identical for these three scenarios. Two crew members at each end of the train, for a total of four, access the stepladder described in Subsection 2.3.10.2, on page 2-178, "Stepladder". To install the stepladder, it is brought to full extension and mounting brackets are inserted into the anchors located on the side door threshold. The stepladder can accommodate a wide range of ground elevations while maintaining the steps aligned in a horizontal position.

2.3.12.2 Tunnels. The safety devices and procedures to be employed during unscheduled stops vary from one tunnel to another:

If there is enough available space between the tracks, the stepladders can be used and installed as described above.

If the stepladder cannot be retrieved due to the proximity of the tunnel wall, the crew members or passengers must retrieve the foldable ladders before exiting the car. The ladders can then be installed through the crew selected doorways. (The ladders are equipped with hooks that can be inserted in the anchor points located on the outer side sill.)

If the clearance between the tunnel wall and the car is extremely small, no external safety device can be used. In this case, egress is accomplished by using the side doors of the end coach car or first class car on the side allowing the most clearance. Passengers can then climb up onto the platform with the assistance of crew members.

2.3.12.3 Bridges. When the train is stopped on a bridge, the stepladders or the foldable ladders can be used for passenger egress. The angle at which the stepladders or ladders can be installed varies depending on the proximity of the edge of the bridge. Egress is to be accomplished using the side doors on of the end coach car or first class car on the side allowing the most clearance and safety.

2.3.12.4 Inspection Car. In the event of an unscheduled stop, when the end coach car is replaced by an inspection car, crew members can use the stepladder of the inspection car. The stepladder installation is accomplished by inserting the mounting brackets into the anchors located on the side door threshold of the adjacent coach car. Passengers are then instructed to egress through the coach car vestibule and out the crew selected side doors.

2.3.12.5 Crew Members Egress - Power Car. In the event of an unscheduled stop, crew members in the power car can egress through a side door of the power car and use the exterior ladder. They may also walk across the equipment room through the door at the R-End and disembark using the side doors of the vehicle adjacent to the power car.

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CHAPTER 3
TROUBLESHOOTING PROCEDURES

3.1 TROUBLESHOOTING CHARTS. This chapter contains all the necessary instructions informing the trainset crew on how to efficiently troubleshoot the equipment for all systems and subsystems. The troubleshooting tables list symptoms, probable causes and *effects*, and corrective actions. Possible combinations of malfunctions are not listed. It is assumed that all control devices were previously set for normal operating conditions as described in chapter 2, "Operating Instructions." The CAR column indicates the car types: ALL for all types of cars, PC for the power car, CO for the coach car, EC for the end coach car, CA for the cafe car, FC for the first class car. If no car type is indicated, the information is applicable to all the passengers car types.

NOTE:

In all cases, if the corrective actions do not correct the problem, or if a symptom is not listed in the troubleshooting table, refer to maintenance personnel.

CAUTION:

Circuit breakers tripped by an overload must be reset only once to prevent damage to the equipment circuitry.

WARNING:

AMTRAK OPERATING RULES AND INSTRUCTIONS MUST BE FOLLOWED WHEN RESETTING ANY DISABLED EQUIPMENT TO CONTINUE.

WARNING:

ANY CIRCUMSTANCE REQUIRING THAT A LEAD AND WIRE SEAL BE BROKEN TO USE A CIRCUIT BYPASS SWITCH MUST BE REPORTED TO AUTHORIZED PERSONNEL.

3.2 ALARMS. For some of the systems listed below, alarms are displayed on the MFD1 and MFD2 to alert the engineer in the case of a true alarm operational situation that requires immediate corrective action.

Refer to subsection 2.1.12.7.2, on page 2-92, "Alarms" for a detailed list of all the alarms that can be displayed on the MFD1 and MFD2.

All alarms appear on the screen as shown in capital letters in the INDICATION column of the following troubleshooting tables.

If an alarm help procedure is available on the screen, it is identified as such and shown as the first item in the CORRECTIVE ACTION column of the following troubleshooting tables.

There are 3 levels of alarm criticality, as explained below.

NOTE:

All levels of alarms are detailed in the troubleshooting tables. The alarm level is indicated in parentheses directly after the alarm text.

3.2.1 Level 1, Safety Affecting Alarms. This level of alarm is indicated by the text flashing in red on the MFD (until acknowledgement), and an audible warning. It indicates a condition that may put the equipment and/or its passengers in a safety critical situation. Immediate operational action is required by the engineer to reduce safety risks. An acknowledgement is required, and a help procedure is available on the screen.

3.2.2 Level 2, Service Affecting Alarms. This level of alarm is indicated by the text flashing in yellow on the MFD (until acknowledgement), and an audible warning. It indicates a condition that results in a speed reduction or limitation. An action may be taken by the Engineer to regain maximum available operating conditions. An acknowledgement is required, and a help procedure is available on the screen.

3.2.3 Level 3, Advisory Alarms. This level of alarm is indicated by the static text in white on the MFD. It indicates a condition that results in a degraded performance of the affected subsystem. It is also used to indicate to the engineer certain noncritical operational status. No acknowledgement is required, and no help procedure is available.

SECTION 3.1
CARBODY

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Damaged panel on front nosing.	Small cracks or punctures. Large cracks, holes, and broken section.	Refer to maintenance personnel.
PC	Sanding not operating.	Circuit breaker CB91, SNOW/PARKING/ SANDING BRAKE, tripped. Electric circuit is open. No air supply available. Debris.	Reset circuit breaker. Refer to maintenance personnel.
PC	Retractable mirror not operating.	Circuit Breaker CB56, GENERAL CONTROL, is tripped. Electric circuit is open. No air supply available.	Reset circuit breaker. Refer to maintenance personnel.
PC	Retractable mirror operation is too slow.	Retractable mirror control valves misadjusted.	Refer to maintenance personnel.
PC	Bell not operating.	Circuit Breaker CB54, CAB CONTROL F-End, or CB55, CAB CONTROL R END, is tripped. Electric circuit is open. No air supply available.	Reset circuit breaker. Refer to maintenance personnel.
PC	Horn not operating.	Circuit Breaker CB54, CAB CONTROL F-End, or CB55, CAB CONTROL R END, is tripped. Electric circuit is open. No air supply available.	Reset circuit breaker. Refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Windshield heaters (defrost) not operating.	Circuit Breaker CB25, WINDSHIELD HEATER FRONT (F-End), or CB26, WINDSHIELD HEATER REAR (R-End), tripped. Electric circuit is open. Heaters are defective.	Reset circuit breakers. Refer to maintenance personnel.
PC	Cab window balance system is too loose.	Springs are not tight enough.	Refer to maintenance personnel.
PC	Adjustable footrest not operating.	Circuit breaker CB45, FOOT PLATFORM, tripped. Electric circuit is open. No air supply available. Operating pressure is out of range. Objects or dirt stop adjustable footrest movement.	Reset circuit breaker. Refer to maintenance personnel.
PC	Adjustable footrest raising and lowering too slow.	Control valves unadjusted. Air filter blocked. Dirty exhaust mufflers.	Refer to maintenance personnel.

SECTION 3.2
TRUCK AND SUSPENSION

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
ALL	HOT JOURNAL (Alarm level 1). Car number and wheels (L1 to L4, R1 to R4) are identified.	Journal bearing overheating (212 °F detected) on the specified wheel of the car. *Quick bearing degradation.*	Alarm help procedure: Will cause on-board speed restriction (20mph) Stop train Check journal temperature using tempil stick (212 deg) If hot journal confirmed proceed as per special instructions If false alarm cutout defective sensor on ITSU Notify Dispatcher.
PC	UNKNOWN SPEED RESTRICTION (Alarm level 1).	Real cause unknown when alarm activated. *Speed restricted to 20 mph.*	Alarm help procedure: Will cause on-board speed restriction (20mph) Could be caused by: -Fire Control Unit -Integrated Truck Surv. (Confirm using MFD-2) Proceed as per special instructions Notify Dispatcher.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	CAR NOT CENTERED (Alarm level 1).	A car is not centered and the tilting system is off. *Speed restricted to 20 mph.*	Will cause on-board speed restriction (20mph) Stop trainset on tangent tracks and verify if car is centered: -Reach one side of a truck -Check that "MUST FIT" NO-GO gauge fits around the nut attaching Air Bag seating to bolster -Check that "MUST NOT FIT" NO-GO gauge does not fit around the nut attaching Air Bag seating to bolster -Repeat for both trucks If car is centered and locked: -Put CDCOS in cutout -Proceed as per special instructions
ALL	BRG SENSOR FAULT (Alarm level 2). Car number and wheels (L1 to L4, R1 to R4) are identified.	One of the integrated truck surveillance system journal bearing sensor is defective. The journal bearing can overheat without being detected. *Loss of hot bearing detection for that wheel. Quick bearing degradation can occur.*	Alarm help procedure: Will cause on-board speed restriction (20mph) Stop train Check journal temperature using tempil stick (212 deg) If hot journal confirmed proceed as per special instructions If false alarm cutout defective sensor on ITSU Notify Dispatcher.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
ALL	TRUCK HUNTING (Alarm level 2). Car number and ends, front (F), rear (R), are identified.	Truck lateral acceleration too high. *Truck instability.*	Alarm help procedure: Reduce speed in 5mph increments until hunting stops Resume normal speed when fault clears Notify Dispatcher of track location.
ALL	TRUCK HUNT FAULT (Alarm level 2). Car number and ends, front (F), rear (R), are identified.	One of the truck accelerometer is defective.The truck lateral acceleration can be too high without being detected. *Loss of truck hunting detection for that truck. Truck instability can occur.*	Alarm help procedure: Will cause on-board speed restriction (20mph) until defective sensor is bypassed Proceed as per special instructions.
ALL	TRUCK SURVEIL FAULT (Alarm level 2). Car number identified.	Defective ITSU. Any bearing can overheat and any truck lateral acceleration can be too high without being detected. *Loss of hot bearing and truck hunting detection. Quick bearing degradation and truck instability can occur.*	Alarm help procedure: Will cause on-board speed restriction (20mph) until ITSU is bypassed Proceed as per special instructions.
	TILTING FAULT (Alarm level 2). Car number identified.	Major fault in the tilting system. *All cars should recenter.*	Alarm help procedure: All cars will be automatically recentered. Proceed as per special instructions.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
ALL	BRG SENSOR BYPASS (Alarm level 3). Car number and wheels (L1 to L4, R1 to R4) are identified.	One of the integrated truck surveillance system journal bearing sensor is bypassed. The journal bearing can overheat without being detected. *Loss of hot bearing detection for that wheel. Quick bearing degradation can occur.*	This alarm comes on when a sensor is bypassed on the ITSU. The degraded mode remains active until the unit is shut down and restarted.
ALL	TRUCK HUNT BYPASS (Alarm level 3). Car number and ends, front (F), rear (R), are identified.	One of the truck accelerometer is bypassed. The truck lateral acceleration can be too high without being detected. *Loss of truck hunting detection for that truck. Truck instability can occur.*	This alarm comes on when an accelerometer is bypassed on the ITSU. The degraded mode remains active until the unit is shut down and restarted.
ALL	TRUCK SURVEIL C/O (Alarm level 3). Car number identified.	Defective ITSU bypassed with the cutout switch. Any bearing can overheat and any truck lateral acceleration can be too high without being detected. *Loss of hot bearing and truck hunting detection. Quick bearing degradation and truck instability can occur.*	This alarm comes on when the ITSU is bypassed.
PC	ON BOARD RESTRICTION C/O (Alarm level 3). Power car number identified.	ONBOARD TL switch placed in BYPASS position. On board failure trainline deenergized. *All alarms related to the truck surveillance system and the fire detection are nor detected. The red ONBOARD FAILURE indicator is ineffective.*	This alarm comes on when the onboard failure trainline is bypassed as a last resort to recover normal operation. Notify dispatcher and refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	AIR BAG DEFLATED (Alarm level 3). Car number identified.	Improper air pressure on an air bag for a particular truck as detected from the car ITSU. *Air bags deflated on that truck.*	Notify dispatcher and refer to maintenance personnel.
	TILTING CENTERED C/O (Alarm level 3). Car number identified.	Centering detection cut-off switch activated in a car. *Loss of car centering detection.*	Notify dispatcher and refer to maintenance personnel.
PC	TILTING SIMULATION MODE (Alarm level 3).	Power car tilting master controller in simulation mode. *Tilting simulation mode in effect.*	Refer to maintenance personnel.
PC	Rough lateral ride.	Defective lateral shock absorber.	Check for oil leakage and for loose mounting bolts.
PC	Rough vertical ride.	Defective vertical shock absorber.	Check for oil leakage and for loose mounting bolts.

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SECTION 3.3
COUPLER

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Coupler does not couple and/ or uncouple.	Foreign material in coupling mechanism. Coupler head is out of acceptable working tolerance.	Remove foreign material. Inspect coupler head to ensure that it is in working order. If in order, recouple, if not, remove from service.
	Draw bar does not couple and/ or uncouple.	Foreign material in coupling mechanism.	Remove foreign material Refer to maintenance personnel.
	Train cars separate	Broken part.	Refer to maintenance personnel.

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SECTION 3.4
ELECTRICAL DISTRIBUTION SYSTEM

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	BATTERY OVERTEMP (Alarm Level 1).Car number identified.	The power car LVBC unit has detected an over-temperature condition in the battery. *Overtemperature in the battery racks at the rear of the car.*	Alarm help procedure: Battery protection system Open battery CB (CB50 or remote shunt trip above the exit doors) Proceed
PC	BATTERY CHARGERS FLT (Alarm Level 2). Car number identified.	Neither LVBC is functioning. *Batteries take over supply of 72 Vdc.*	Alarm help procedure: No Battery Charger (WARNING: Max 20 minutes operating time left) Proceed to nearest station if possible Notify Dispatcher.
PC	BATTERY CB OPEN (Alarm Level 2). Car number identified.	The battery circuit breaker is in open position. *Battery power not available.*	Alarm help procedure: Battery power unavailable (Caution: penalty may occur upon MCB opening) Continue operation When practical, close Battery breaker (CB50, next to rear door, left side)
PC	LOAD SHED LEVEL 2 FLT (Alarm Level 2). Car number identified.	Battery load shed level 2 lost while level 1 load shed is still present. Circuit breaker CB81, Monitoring Input/Output, open (turned off). *A fault in a trailing power car, could cause loss of marker lights and other equipment.*	Reset any tripped circuit breaker. If the alarm is still present, notify dispatcher.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	MAIN 480 VAC CB OPEN (Alarm Level 3). Car number identified.	Main 480 V circuit breaker is open in a car *Battery power (72 Vdc) only available in that car.*	Reset tripped circuit breaker. If the alarm is still present, notify dispatcher.
PC	One or both battery charger (s) not operating.	Circuit Breaker CB31, Battery Charger No. 1 (CB-BA-CH-1) and/or CB32, Battery Charger No. 2 (CB-BA-CH-2) tripped.	Reset circuit breaker.

SECTION 3.5
LIGHTING AND INDICATORS

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Marker lights not illuminated.	Marker lights switch on OFF position.	Verify marker lights switch position.
		Marker lights circuit breaker, CB59, tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Headlights not illuminated.	Headlights switch on OFF position.	Verify headlights switches position.
		Headlights circuit breaker, CB60, tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Ditch lights not illuminated.	Headlights switch on OFF position.	Verify headlights switches position.
		Ditch lights switch on OFF position.	Verify ditch lights switch position.
		Ditch lights circuit breaker, CB76, tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Exterior ground light not illuminated.	Interior or exterior switch not activated.	Verify switches position.
		Access lighting circuit breaker, CB52, tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Cab lights not illuminated.	Switches on OFF position.	Verify switches position.
		Cab lighting circuit breaker, CB57, tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Cab Walkway Lights not illuminated.	Switches on OFF position.	Verify switches position.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
		Walkway lighting circuit breaker, CB58, tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Individual group of the cab lights are extinguished.	Switch on OFF position.	Verify switch position.
		Tripped circuit breaker controlling particular group of lights.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
PC	Individual lighting fixture is extinguished.	Lighting switch is off.	Verify switch position.
		No lighting for specific location.	Verify lamp condition.
CO, EC, FC	Mirror & Advertisement Lights are not functioning.	Circuit breaker Mirror and Advertisement Lights, CB67, is tripped.	Reset circuit breaker.
CO, EC, FC	Right and/or Left Aisle Lights are not functioning.	Circuit breaker, Indirect & Aisle Lights Right and/ or Left, CB68 or CB92 are tripped.	Reset circuit breaker.

SECTION 3.6
DOORS, DOOR CONTROL AND SIGNAL SYSTEM

NOTE:

If a DCS is defective, to reset all faults, place key in ISOL and press on LAMP TEST Button. If that fails, reset breaker to recover normal operation. If this fails, refer to maintenance.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	EMERG DOOR RELEASED (Alarm Level 1).Car number identified.	An emergency door release handle has been activated in a car. *Unlocked door in that car and loss of traction power for the trainset.*	Alarm help procedure: Loss of traction power Stop trainset View MFD-2 to identify door location Close emergency handle Notify Dispatcher
PC	DOORS C & L BYPASS (Alarm Level 3). Car number identified.	DOORS CLOSED AND LOCKED switch set to BYPASS. *The switch is used only when a wrong door open signal has to be bypassed to recover traction power.*	Verify that all doors in the consist are effectively closed and locked prior to train movement.
PC	DOORS OPEN INHIBIT (Alarm Level 3). Car number identi-fied.	DOOR OPEN inhibit pushbutton depressed in the active cab. *Trainset doors cannot be opened.*	Release DOOR OPEN inhibit pushbutton to allow door opening.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	Local side door does not open.	Door has been isolated	Check that DCS key switch is set to ON position.
		Crew switch in use.	Check that neither crew switch has been set to CLOSE position. The crew switch overrides DCS commands.
		Train is not stationary.	Door does not open if train is motion.
		DCS HEALTHY is not illuminated and/or the verbal announcement indicator is flashing.	Isolate door. Refer to maintenance personnel.
	Local side door does not close.	Door has been isolated	Check that DCS key switch is set to ON position.
		Crew switch in use.	Check that neither crew switch has been set to OPEN position. Crew switch overrides DCS commands.
		Emergency release is operated.	Check that neither emergency release has been operated and left in extended position.
			If an emergency release is operated, door can only be opened and closed manually.
		There is an obstacle detected.	Check that door is not blocked.
		DCS failure. DCS HEALTHY is not illuminated and/or the verbal announcement indicator is flashing.	Isolate door. Refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	Passenger Door Open Pushbutton does not function.	Train is in motion.	Pushbutton does not illuminate if train is in motion.
		ENABLE is not pressed on the local DCS.	Local DCS ENABLE indicator has to be illuminated (pressed).
		DCS fault.	Isolate door. Refer to maintenance personnel.
	Side door does not lock.	Door not fully closed.	Clear any object that may be preventing door from closing.
	Collision Post and Body End Doors do not open.	Wrong operating mode selected.	Check that mode selector is set to NORMAL position. In MANUAL position, door does not open automatically.
		Infra Red sensor failed.	Press passenger door pushbutton. If door opens, there is a problem with the infrared sensor. Refer to maintenance personnel.
	Doors do not close.	Wrong operating mode selected.	Check that mode selector is set to NORMAL position. In MANUAL position, door does not close automatically. In OPEN position, doors remain open.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
		Side door open.	If side door adjacent to interior door is open, interior door remains open for 30 seconds after side door has closed, or for 5-6 minutes, whichever occurs first.
		An obstacle has been detected.	Clear any object from doorway.
	Only one of the doors opens.	Door track blocked.	Clear any object from doorway. Refer to maintenance personnel.

SECTION 3.7
HEATING, VENTILATION, AND AIR CONDITIONING

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Cab does not cool, but blower fan is operating.	HVAC Unit circuit breaker, CB21, is tripped.	Reset circuit breaker.
PC	Blower fan is not operating.		Refer to maintenance personnel.
PC	Compressor short cycles.		Refer to maintenance personnel.
PC	Compressor runs continuously. High temperature in conditioned area.		Refer to maintenance personnel.
PC	Oil leak.		Refer to maintenance personnel.
PC	Liquid refrigerant leak.		Refer to maintenance personnel.
PC	Compressor is noisy.		Refer to maintenance personnel.
PC	Air flow normal but too cold.	HVAC Unit circuit breaker, CB21 is tripped.	Reset circuit breaker.
PC	Cooling stops during operation.	HVAC Unit circuit breaker, CB21 is tripped.	Reset circuit breaker.
PC	Cab does not heat (neither forced air cab heaters nor overhead heaters).		Refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Forced air cab heater does not heat.	Cab heater switch in wrong position. Cab heater circuit breaker, CB 23 is tripped.	Set cab heater switch to HEAT position. Reset circuit breaker.
PC	Module B heater bank does not heat.	HVAC Unit circuit breaker, CB21 is tripped.	Reset circuit breaker.
PC	Car does not heat when selector switch is set to layover.		Refer to maintenance personnel.
PC	No heat available at heat traces.	Freeze protection circuit breaker, CB41, is tripped.	Reset circuit breaker.
PC	Noisy blower operation.		Refer to maintenance personnel.
PC	Toilet too hot or too cold.	Thermostat is defective.	Refer to maintenance personnel.
PC	Windshield heater and defogger does not operate.	Windshield Heater and Defogger, circuit breaker, CB25 is tripped.	Reset circuit breaker.
PC	Windshield heater and defogger operates but does not heat.		Refer to maintenance personnel.
PC	Windshield heater and defogger operates but does not defog.		Refer to maintenance personnel.
	Vestibule (A or B) does not heat.	Circuit breaker Vestibule Heat A or B, CB12, CB15, are tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	Floor does not heat.	Circuit breaker Floor Heat 1 or 2, CB10, CB11, are tripped.	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary.
	Noisy blower operation.		Refer to maintenance personnel.

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SECTION 3.8
COMMUNICATION SYSTEMS

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Assistant's headset station does not operate.	Circuit Breaker CB63, COMMUNICATION CONTROL/RADIO is tripped.	Reset circuit breaker.
PC	Remote control head does not operate.	Circuit Breaker CB63, COMMUNICATION CONTROL/RADIO is tripped.	Reset circuit breaker.
PC	With the remote control head, radio communication does not function.	RAD button is not in Radio mode of operation.	Select Radio mode of operation. Keep PTT button pressed while talking or the footswitch.
PC	With the remote control head, intercom (IC) communication does not function.	IC button is not in IC mode of operation.	Select IC mode of operation. Keep PTT button pressed while talking or the footswitch.
PC	With the assistant's headset station, radio communication does not function.	Mode button is not in radio mode of operation.	Select radio with the MODE button. Keep PTT button pressed while talking.
PC	With the assistant's headset station, IC communication does not function.	MODE button is not in IC mode of operation.	Select IC with MODE button. Keep PTT button pressed while talking.
	Attendant call system does not function.	Circuit Breaker CB79, COMMUNICATION SYSTEM is tripped.	Reset circuit breaker.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	Public address does not function in some coaches.	PA zoning is not correct.	In the workstation of the cafe car, verify the PA zoning.

SECTION 3.9
PROPULSION AND ELECTRIC BRAKING

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	EMI LIMIT EXCEEDED (Alarm Level 1). Car number identified.	High level of electromagnetic interference detected by the EMI limit detector. *MCB open.* *The EMI limit detector (electrical locker No. 2) gives the following indications: For all monitored frequencies (100, 150, 200, 250 Hz), a continuously illuminated red LED indicates that harmonic interference is detected. A flashing red LED indicates MCB has been opened but interference is below threshold.*	Alarm help procedure: Close MCB Proceed.
PC	FIRE DETECTED (Alarm Level 1). Car number identified.	Fire detected in the equipment room. *Automatic suppression occurs 2 minutes after announcement of alarm if no acknowledge.*	Acknowledge with MFD1 or FIRE SUPP. INHIBIT pushbutton to inhibit automatic fire extinguishing. Fire suppression is automatic after two minutes with no acknowledgment. Whenever the alarm is acknowledged, check in the equipment room. In case of fire, initiate manual fire suppression with the FIRE SUPP. ACTIVATION pushbutton.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	UNKNOWN SPEED RESTRICTION (Alarm level 1).	Real cause unknown when alarm activated. *Speed restricted to 20 mph.*	Alarm help procedure: Will cause on-board speed restriction (20mph) Could be caused by: -Fire Control Unit -Integrated Truck Surv. (Confirm using MFD2) Proceed as per special instructions Notify Dispatcher.
PC	TRACTION STILL APPLIED (Alarm Level 1). Car number identified.	This alarm occurs when one or more power car continues to apply traction effort during a penalty brake application.	Alarm help procedure: Was traction removed from both Power Car? Yes: Sensor Fault -Proceed No: Traction Fault -Lower Panto on faulty PWC -Proceed (50% traction)
PC	LOW TRANSFORMER OIL (Alarm Level 1). Car number identified.	Cooling medium in main transformer is too low to provide adequate cooling.	Alarm help procedure: Check oil level If level OK, cutout sensor Proceed. To check the oil level, refer to maintenance for access to the central block. If the oil level is low, notify dispatcher.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	BATTERY CB OPEN (Alarm Level 2). Car number identified.	The battery circuit breaker is in open position. *Battery power not available.*	Alarm help procedure: Battery power unavailable (Caution: penalty may occur upon MCB opening) Continue operation When practical, close Battery breaker (CB50, near batteries, next to rear door, left side)
PC	ELD FAULT/ LOCKED OUT (Alarm Level 2). Car number identified.	EMI Limit Detector is in fault/lockout. *Traction power not available.*	Notify dispatcher and refer to maintenance personnel.
PC	MAIN CB LOCKED OUT (Alarm Level 2). Car number identified.	Repetitive MCB fault. *MCB locked out.* *Traction power not available.*	Notify dispatcher and refer to maintenance personnel.
PC	TRACTION LOSS 50% (Alarm Level 2). Car number identified.	One truck has lost traction power. Each truck accounts for 50%. *Reduced traction power.*	Alarm help procedure: Proceed To view flt log see MFD-2
		One of the motor block blower circuit breaker, CB3, CB4, CB5, CB6 (CB-MF-PCS-1/2/3/4) tripped. One of the motor block water pump circuit breaker CB10, CB11, (CB-M-WP-1/2) tripped. One of the main transformer blower circuit breaker CB1, CB2 (CB-MF-MT-1/2) tripped.	Reset any tripped circuit breaker.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	TRACTION LOSS 100% (Alarm Level 2). Car number identified.	All four traction motors have lost power. Each motor accounts for 25%. *Loss of traction power.*	Notify dispatcher and refer to maintenance personnel.
		One of the motor block blower circuit breaker, CB3, CB4, CB5, CB6 (CB-MF-PCS-1/2/3/4) tripped. One of the motor block water pump circuit breaker CB10, CB11, (CB-M-WP-1/2) tripped. One of the main transformer blower circuit breaker CB1, CB2 (CB-MF-MT-1/2) tripped.	Reset any tripped circuit breaker.
PC	HEP FAULT (Alarm Level 2). Car number identified.	No 480 Vac available at auxiliary transformer output. *No 480 Vac available to supply passenger cars.*	Alarm help procedure: Notify Dispatcher To view flt log see MFD-2
PC	ELECT BRAKE LOSS 50% (Alarm Level 2). Car number identified.	The two traction motors on a single truck have lost ability to regenerate power. Each motor accounts for 25%. *Reduced electric braking power.*	Alarm help procedure: Proceed To view flt log see MFD-2
		One of the main transformer blower circuit breaker CB1, CB2 (CB-MF-MT-1/2) tripped.	Reset any tripped circuit breaker.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	ELECT BRAKE LOSS 100% (Alarm Level 2). Car number identified.	All four traction motors in a power car have lost ability to regenerate power. Each motor accounts for 25%. *Reduced electric braking power.*	Refer to maintenance personnel.
		One of the main transformer blower circuit breaker CB1, CB2 (CB-MF-MT-1/2) tripped.	Reset any tripped circuit breaker.
PC	CAT VOLTAGE BELOW 8.4 KV (Alarm Level 2)	Catenary voltage is 30% below nominal 12 kV. *Reduced power available to propulsion system.*	Alarm help procedure: Automatic traction power reduction Proceed.
PC	CAT VOLTAGE BELOW 8.7 KV (Alarm Level 2)	Catenary voltage is 30% below nominal 12.5 kV. *Reduced power available to propulsion system.*	Alarm help procedure: Automatic traction power reduction Proceed.
PC	CAT VOLTAGE BELOW 17.5 KV (Alarm Level 2)	Catenary voltage is 30% below nominal 25 kV. *Reduced power available to propulsion system.*	Alarm help procedure: Automatic traction power reduction Proceed.
PC	PANTO F BROKEN (Alarm Level 2). Car number identified.	Front pantograph is broken. *Front pantograph should be down.*	Alarm help procedure: Ensure panto is down Perform visual inspection Cutout panto air supply Move panto selector switch to Rear Raise rear panto Proceed

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	PANTO R BROKEN (Alarm Level 2). Car number identified.	Rear pantograph is broken. *Rear pantograph should be down.*	Alarm help procedure: Ensure panto is down Perform visual inspection Cutout panto air supply Move panto selector switch to Front Raise front panto Proceed
PC	PANTO F TOO HIGH (Alarm Level 2). Car number identified.	Front pantograph is higher than 24 ft. 6 in. *Possible damage to the catenary.*	Refer to maintenance personnel.
PC	PANTO R TOO HIGH (Alarm Level 2). Car number identified.	Rear pantograph is higher than 24 ft. 6 in. *Possible damage to the catenary.*	Refer to maintenance personnel.
PC	PANTO PB ACTIVATED (Alarm Level 3). Car number identified.	PANTO-DOWN pushbutton activated in a power car cab. *Pantograph cannot be raised.*	Reset PANTO-DOWN pushbutton by pressing on it.
PC	CARD READER C/O (Alarm Level 3). Car number identified.	Key card reader bypass switch activated. *Trainset can be operated at any speed without proper authorization level.*	Refer to maintenance personnel.
PC	FIRE OUTPUTS C/O (Alarm Level 3). Car number identified.	Fire control unit bypass switch (propulsion electrical cubicle) activated. *Fire suppression system is cutout.*	Refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	FIRE SUPP INHIBITED (Alarm Level 3). Car number identified.	Fire detected alarm acknowledged on MFD1 or FIRE SUPP. INHIBIT pushbutton (cab rear wall switch panel) activated. *Fire suppression is inhibited.*	In case of fire, fire suppression can be activated with FIRE SUPP. ACTIVATION pushbutton on cab rear wall switch panel. Notify dispatcher and refer to maintenance personnel.
PC	FIRE SUPP CYL BYPASS (Alarm Level 3). Car number identified.	Fire suppression cylinder is bypassed. *Extinguishing agent cannot be discharged.*	Notify dispatcher and refer to maintenance personnel.
PC	ON BOARD RESTRICTION C/O (Alarm level 3). Car number identified.	ONBOARD TL switch placed in BYPASS position. On board failure trainline deenergized. *All alarms related to the truck surveillance system and the fire detection are nor detected. The red ONBOARD FAILURE indicator is ineffective.*	This alarm comes on when the onboard failure trainline is bypassed as a last resort to recover normal operation. Notify dispatcher and refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	MAIN CB OPEN (Alarm Level 3). Car number identified.	MCB manual selector set to OPEN position. Overcurrent detected in main transformer primary. No current return to ground. Inverter or FCRB failure. Fire detected. EMI limit exceeded, or lockout. Pantograph down command detected. Insufficient air pressure. Propulsion (PECU) MCB close command not present. Overtemperature detected in main transformer. *Main circuit breaker open.*	Acknowledge. Since high voltage power is unavailable, come to a controlled stop. Check for other alarms to determine the cause of the problem. Check and reset circuit breaker CB1, Rheostatic and Main Transformer Blower No. 1 (CB-MF-MT-1). Notify dispatcher and refer to maintenance.
PC	HEP OUTPUT OFF (Alarm Level 3).	HEP switch set to OFF position. *No HEP supplied to passenger cars.*	Set HEP switch to ON position.
PC	CAT VOLTAGE BELOW 10.8KV (Alarm Level 3).	Catenary voltage is 10% below nominal 12 kV.	Notify dispatcher if required.
PC	CAT VOLTAGE BELOW 11.2KV (Alarm Level 3).	Catenary voltage is 10% below nominal 12.5 kV.	Notify dispatcher if required.
PC	CAT VOLTAGE BELOW 22.5KV (Alarm Level 3).	Catenary voltage is 10% below nominal 25 kV.	Notify dispatcher if required.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	NO 480V T/L CONT. (Alarm Level 3).	480 VAC trainline loop is open. *HEP not available if speed is below 5 mph.*	Notify dispatcher and refer to maintenance.
PC	TRANS-FORMER OIL C/O (Alarm Level 3). Car number identified.	Transformer oil detector in cutout (oil level detector bypass switch activated). One of the main transformer oil pump circuit breaker CB13, CB14 (CB-M-OP-1/2) tripped. *Overheating of main transformer is no longer detected.*	Acknowledge. Reset circuit breaker. Stop train as soon as possible. Meanwhile reduce speed and, consequently, power handled by main transformer.

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SECTION 3.10
FRICTION BRAKE EQUIPMENT

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	BRAKE CONTROL FAULT (Alarm Level 1). Car number identified.	The brake parameters monitored by the independent failure monitor (brake pipe pressure, electric (dynamic) brake feedback, brake handle position) do not match with brake handle position command. *Brake effort is probably not equal to brake demand*	Alarm help procedure: Pneumatic Backup activated Perform running brake test If brake response proceed If no brake response then apply Emergency brake.
ALL	CONDUCTOR VALVE APPL (Alarm Level 1)	Emergency brake valve applied in a power car cab, or equipment room, or in any passenger car. *Emergency Brake Applied.*	Alarm help procedure: Identify car then reset valve (see MFD-2).
ALL	LOCKED AXLE (Alarm Level 1). Car number and axles (1 to 4) are identified.	A locked axle is detected on the trainset.	Alarm help procedure: Activate TECC on the affected truck.
PC	CANNOT ANNOUNCE > 15% LOSS (Alarm Level 2)	The brake system cannot announce a loss of 15% of its brake capacity.	Alarm help procedure: Communication problem Perform running brake test If Ok then proceed
PC	LOSS OF > 15% FRICTION BRAKE (Alarm Level 2)	The brake system detects a loss of 15% of its brake capacity.	Operate in accordance with railroad operating rules and instructions.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
ALL	NO WHEEL SLIP PROTEC (Alarm Level 2). Car number identified.	Fault of wheelslide control computer and major fault of detection of non-rotating axle. *No protection against wheelslip/slide.*	Do not apply the brake at a greater rate than suppression until stopped, then cut out the brakes to proceed. Refer to Amtrak operating rules and instructions for operation with brakes cut out.
ALL	TRUCK EQ C/O (Alarm Level 3). Car number and trucks (1 and 2) are identified.	Interior or exterior truck brake equipment cutout cock activated. *No brakes available on that truck.*	Refer to Amtrak operating rules and instructions for operation with brakes cut out.
PC	SNOW BRAKE APPLIED (Alarm Level 3)	Snow brake activated. *Normal condition: brake cylinder pressure at 6 psi on all brake units for 60 seconds.*	Notify dispatcher and refer to maintenance if snow brake is activated for more than 60 seconds.
PC	SANDING (Alarm Level 3)	Sanding activated. *Normal condition: sanding activated only if trainset is at more than 3 mph. Sanding automatic in emergency.*	Notify dispatcher and refer to maintenance if sanding is activated when trainset is not in motion.
PC	PNEUMATIC BACKUP ACTIVE (Alarm Level 3)	Brake system is in pneumatic backup mode. *Brake Control Computer has failed.*	Refer to maintenance personnel.
PC	EMERG C/O COCK (Alarm Level 3). Car number identified.	Emergency Magnet Valve Cutout Cock (EMVCC) activated. *Emergency magnet valve cutout.*	Notify dispatcher and refer to maintenance.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	BRAKE OFF SWITCH ACT (Alarm Level 3). Car number identified.	BRAKE OFF switch activated in a passenger car. *Brakes cut out for that car*	Refer to Amtrak operating rules and instructions for operation with brakes cut out. Notify dispatcher and refer to maintenance personnel.
PC	ALL BRK RELEASED C/O (Alarm Level 3). Car number identified.	ALL BRAKE RELEASED TL. bypass switch activated in the power car. *Brakes released status not available on MFD1.* *The brakes could be applied on any car in the trainset.*	Notify dispatcher and refer to maintenance. Make sure that all brakes are released prior to train movement.
PC	Service brakes do not apply.	Dump valves not functioning.	Refer to maintenance personnel.
		Truck Equipment Cut-out cock (TECC) 1 &2 open.	Close TECC 1 &2.
		Brake Cylinder Relay Valve not functioning.	Refer to maintenance personnel.
		Snow Brake Double Check Valve not functioning.	Refer to maintenance personnel.
		KE Valve not functioning.	Refer to maintenance personnel.
		Brake pipe cutout cock. is open.	Close cut-out cock.
		Brake pipe relay is open or not functioning.	Close BPRV.
		No MR pressure.	Refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Emergency Brakes do not apply.	Automatic brake control lever is not functioning. Brake pipe relay valve is closed or not functioning. Emergency magnet valve is open or not functioning. Brake Control Computer (BCC) failure. KM-2 rapid vent valve closed or not functioning. Emergency magnet valve cutout cock open.	Refer to maintenance personnel. Refer to maintenance personnel. Refer to maintenance personnel. Refer to maintenance personnel. Refer to maintenance personnel. Close EMCC.
PC	Erratic brake function	Leakage from individual components.	Refer to maintenance personnel.

EMERGENCY BRAKE APPLICATION STEP-BY-STEP TROUBLESHOOTING

A. To determine if the emergency condition is caused by a manual device, penalty backup, or operational error, proceed as follows:

1) Verify that ABCL(s) is (are) in HO position. In leading cab, use MFD2 brake status display, to verify handle position in the other power car cab. ABCL(s) need to be in HO.

2) With trainset stopped, verify if EMV (check label on BCU) is warm at touch. If not, BCC is either in penalty backup mode or there is a BCC failure. To determine if BCC is in penalty backup mode, check ER pressure on MFD1. In penalty back-up mode, ER pressure should be 105 psi.

3) Verify that POD displays NO MOTION. If not, with ABCL(s) in HO, use NO-MOTION bypass switch as required.

4) Using MFD2 brake status display, select each individual car and verify if the emergency source is identified. Possible indications in emergency brake box are:

a. "PUSH PB F": Engineer’s or assistant’s emergency brake valve mushroom pushbutton activated in front cab.

b. "PUSH PB R": Engineer’s or assistant’s emergency brake valve mushroom pushbutton activated in rear cab.

c. "BRAKE CONTROL LEVER": ABCL in emergency position

d. "CORD A": Conductor's emergency brake valve activated at A-End of a passenger car or in equipment room.

e. "CORD B: Conductor's emergency brake valve activated at B-End of a passenger car or in equipment room.

f. "EMERGENCY": Indicates that no emergency activation device is set to emergency. Indication provided if there is a break-in-two (BP drops below 50 psi).

5) When emergency activation device is identified by monitoring, try to reset it manually. If identification is not removed from MFD2, problem is electrical.

6) NO MOTION indication on POD is provided by Speed Sensing (SS) system but does not reflect relay status. Depress NO MOTION BYPASS switch. POD should then display NO MOTION BYPASS.

7) If after all these steps, emergency condition is still present, there is a system problem.

B. Determine if the emergency condition is caused by an electrical problem.

NOTE:

Electrical problems troubleshooting should be performed by a qualified electrician. Report any further problem to maintenance.

C. Determine if the emergency condition is caused by a pneumatic problem.

NOTE:

Pneumatic problems troubleshooting should be performed by qualified maintenance personnel. Report any further problem to maintenance.

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SECTION 3.11
CAB SIGNAL AND AUTOMATIC TRAIN CONTROL SYSTEMS

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	1. ACSES		
PC	ACSES FAULT (Alarm Level 1)	Failure of a vital circuit occurs in the ACSES system. *The ACSES magnet valve is dropped, thus causing an irretrievable full service brake application with loss of traction power.*	Alarm help procedure: Cutout electrical portion of ACSES If cannot recover from penalty, cutout ACSES pneumatic magnet valve (blue) Proceed with reduced speed as per operating rules Notify Dispatcher.
PC	ACSES C/O (Alarm Level 3)	Electrical portion of ACSES system bypassed with cutout switch on equipment cabinet. *ACSES system not functional.*	Proceed as per operating rules. Notify dispatcher and refer to maintenance personnel.
PC	ACSES MAGN VALVE C/O (Alarm Level 3)	Pneumatic portion of ACSES system bypassed with penalty magnet valve blue cutout cock on brake control unit. *ACSES system not functional.*	Proceed as per operating rules. Notify dispatcher and refer to maintenance personnel.
PC	ACSES DATA NOT AVAILABLE (Alarm Level 3)	ACSES system offline. *ACSES system not functional.*	Proceed with reduced speed as per operating rules. Notify dispatcher and refer to maintenance.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	2. ALERTER RECORDER		
PC	ALERTER FAULT (Alarm Level 1)	Defective alerter recorder control unit *No alerter functions available*	Alarm help procedure: If cannot recover from penalty, cutout Alerter pneumatic magnet valve (yellow) If audible alarm sounds continuously then break seal and cutout electrical portion of Alerter (Electrical locker #2) Proceed as per special instructions Notify Dispatcher.
PC	EVENT RECORDER FAULT (Alarm Level 2)	Failure of a vital circuit occurs in the recorder portion of the alerter/ recorder control unit. *Events are not recorded.*	No corrective action possible. Note that the electrical cutout on the alerter/recorder control unit in electrical locker No. 2 cuts out the alerter portion only.
PC	ALERTER C/O (Alarm Level 3)	Electrical portion of alerter bypassed with cutout switch on ARU. *Alerter not functional.*	Proceed with reduced speed as per operating rules. Notify dispatcher and refer to maintenance personnel.
PC	ALERTER MAGN VALVE C/O (Alarm Level 3)	Pneumatic portion of alerter bypassed with penalty magnet valve yellow cutout cock on brake control unit. *Alerter not functional.*	Proceed with reduced speed as per operating rules. Notify dispatcher and refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	Alerter acknowledge not available with acknowledge switches.	ATC system not functional. *No acknowledge available for the alerter with the whisker switch or the acknowledge footswitch.*	Use any other means to reset the Alerter. Reset the ATC circuit breaker and/or place the ATSCO switch in NORMAL position to recover normal operation of the ATC system.
	3. ATS/ATC		
PC	ATS/ATC FAULT (Alarm Level 1)	Failure of a vital circuit occurs in the ATS/ATC system. *The ATS/ATC magnet valve is dropped thus causing an irretrievable full service brake application with loss of traction power.*	Alarm help procedure: Break seal and cutout electrical portion of ATC/ATS If cannot recover from penalty, cutout ATC/ATS pneumatic magnet valve (red) Proceed as per operating rules Notify Dispatcher.
PC	ATS C/O (Alarm Level 3)	Electrical portion of ATS system bypassed with ATSCO cutout switch on equipment cabinet. *ATS system not functional.*	Proceed as per operating rules. Notify dispatcher and refer to maintenance personnel.
PC	ATS/ATC MAGN VALVE C/O (Alarm Level 3)	Pneumatic portion of ATS/ATC system bypassed with penalty magnet valve red cutout cock on brake control unit. ATS/ATC *system not functional.*	Proceed as per operating rules. Notify dispatcher and refer to maintenance personnel.
PC	ATS/ATC DATA NOT AVAILABLE (Alarm Level 3)	ATS/ATC system offline. ATS/ATC *system not functional.*	Proceed as per operating rules. Notify dispatcher and refer to maintenance personnel.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC	NO-MOTION BYPASS (Alarm Level 3)	NO-MOTION BYPASS switch activated. *Speed sensing system bypassed.*	Release NO-MOTION BYPASS switch.
	4. SPEED SENSING		
PC	SPEED SENSING FAULT (Alarm Level 1)	Failure of a vital circuit occurs in the speed sensing system. *The ATS/ATC magnet valve is dropped thus causing an irretrievable full service brake application with loss of traction power.*	Alarm help procedure: Break seal and cutout electrical portion of SS Proceed as per operating rules Notify Dispatcher.
PC	SPEED SENSING C/O (Alarm Level 3)	Speed sensing system bypassed with SSCO cutout switch on equipment cabinet. *Speed sensing system system not functional.*	Proceed as per operating rules. Notify dispatcher and refer to maintenance personnel.
	5. PENALTY MAGNET VALVE CUT OUT		
PC	Cannot recover from a penalty brake application.	Defective penalty magnet valve. If the actions taken above do not resolve the problem, then the magnet valve cutout of each system can be used to neutralize the effect on the brake system. ACSES cutout: BLUE ATS/ATC cutout: RED Alerter cutout: YELLOW	If the ATS/ATC magnet valve is cutout, the ACSES enforces a maximum speed command of 79 mph. If the ACSES magnet valve is cutout, the ATS/ATC system is limited to 125 mph as highest speed command.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	6. EMI LIMIT DETECTOR		
PC	EMI LIMIT EXCEEDED (Alarm Level 1). Car number identified.	High level of electromagnetic interference detected by the EMI limit detector. *MCB open.* *The EMI limit detector (electrical locker No. 2) gives the following indications: For all monitored frequencies (100, 150, 200, 250 Hz), a continuously illuminated red LED indicates that harmonic interference is detected. A flashing red LED indicates MCB has been opened but interference is below threshold.*	Alarm help procedure: Close MCB Proceed.
PC	ELD FAULT/ LOCKED OUT (Alarm Level 2). Car number identified.	EMI Limit Detector is in fault/lockout. *Traction power not available.*	Notify dispatcher and refer to maintenance personnel.

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SECTION 3.12
TRAIN MONITORING AND DATA MANAGEMENT SYSTEMS

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
PC, CA	INCOMING TRAIN ORDER (Alarm Level 2)	Train order received from wayside. *Alarm activated after the CMU has received a train order file from the local DMS. Deactivated when the train order has been successfully printed.*	Alarm help procedure: Acknowledge alarm Confirm printout is OK Proceed as per special instructions.
PC	CARD READER C/O (Alarm Level 3). Car number identified.	Key card reader bypass switch activated. *Trainset can be operated at any speed without proper authorization level.*	Refer to maintenance personnel.
ALL	ALARMS NOT AVAILABLE (Alarm Level 3)	The car CMU is not functional. Alarm generated by MFD1, MFD2. *No alarms can be generated.*	Notify dispatcher and refer to maintenance personnel.
PC	CDU displayed time and date do not match current real time and date following reboot.	Trainset reference time not updated.	Refer to maintenance personnel to update reference time.
CA	DMS System is not responding. Power indicator is not illuminated. Indicator lights on external keyboard are not illuminated.	DMS malfunction. Cable damaged or incorrectly assembled.	Refer to maintenance personnel.

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SECTION 3.13
WATER AND WASTE RETENTION SYSTEMS

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
	POWER OFF indicator on.	Toilet control circuit breaker, CB 79, tripped. Main reservoir pressure below 60 psig. Vacuum too low. *No 120 Vac power available and toilet operation disabled*	Verify on breaker panel if breaker has tripped. Reset circuit breaker if necessary. Verify pressure on pressure regulator gauge. Open air isolation valve if closed. Open air ejector valve if closed.
	LOW AIR indicator on.	Main reservoir pressure below 60 psig *Toilet operation is disabled.*	Verify pressure on pressure regulator gauge. Open air isolation valve if closed.
	LOW WATER indicator on.	Water level in water tank less than 1/3	Notify Maintenance.
	NO VACUUM indicator on.	Vacuum too low. *Toilet operation is disabled.*	Open air ejector valve if closed. Notify Maintenance, air ejector might be clogged.
	VALVE OPEN indicator on.	Drain valve open on draining station. *Toilet operation is disabled.*	Close drain valve on both draining station if opened.
	TANK FULL indicator on.	Waste tank full. *Toilet operation is disabled.*	Close lavatory. Notify Maintenance.
	Toilet fails to flush.	No 120 *Vac* power available.	Verify on breaker panel if breaker has tripped - Toilet Control 120V, CB46. Reset circuit breaker if necessary.
		Main reservoir pressure below 60 psig.	Verify pressure on pressure regulator gauge.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
		Drain valve open on draining station.	Open air isolation valve if closed.
		Vacuum too low	Open air ejector valve, if closed. Close drain valve on both draining stations, if opened.
		Flush control and/or isolation valve closed.	Open flush control and/or isolation valve.
PC	No water available.	Water tank empty.	Fill water tank, refer to maintenance personnel.
Water Cooler			
PC	Refrigeration system is not operating.		Refer to maintenance personnel.
	Cooler runs normally but water temperature too high.	Control set too high.	Turn control to colder position.
	Refrigeration system is not operating.		Refer to maintenance personnel.

CHAPTER 4
CAFE CAR AND GALLEYS

SECTION 4.1
EQUIPMENT CHARACTERISTICS

The cafe car is equipped with a cafe galley and a crew office. The end coach car and first class car are equipped with a beverage galley. There is also a food galley in the first class car. The following sections describe the crew office equipment and detail the major components and accessories of the galleys.

4.1.1 CAFE GALLEY (Fig. 4-1 to 4-13). The cafe galley of the cafe car consists of two large galley complexes, an outboard and an inboard complex. Each complex consists of several galley units, each performing its own task. The cafe galley is a service center with a wrap around service bar and display area, which dispenses catered meals, snacks, and a variety of cold and hot beverages. The cafe galley provides the electrical power to run equipment. It provides hot and cold water and power for the oven and the refrigeration system.

When the cafe car is out of service, the cafe galley complex is locked by a door at one end and secured with a security curtain at the other end, which extents from one side of the galley to the opposite galley. A security curtain secures the wraparound service bar when it is not in service. An emergency exit door is installed under the countertop of the wraparound service bar. The door and latch are not visible from the passenger side. (The door opens from the inside of the galley.)

The main electrical panel of the cafe galley contains all the galley circuit breakers. The main circuit breaker provides power to all systems circuit breakers. All chiller systems have the power switch and indicator lights adjacent to their correspondent circuit breaker. The electrical power for the menu and for the work lights is on one circuit breaker.

The cafe galley equipment is divided in two different galleys: outboard galley and inboard galley. The service equipment is detailed in the following subsections.

4.1.1.1 Outboard Galley (Fig. 4-1 to 4-7). Section A provides two coffee tanks and soda in a beverage cart. There are also two ice storage compartments and an ice drawer that allow easy access to the ice from the top of the counter. A chiller provides cooling to the refrigerated carts and the ice storage.

Section B provides a cooking area with two microwave ovens and a convection oven. It also provides hot coffee, dry food storage, and refrigeration areas. Below the cooking area, there are three refrigerated carts for short term storage of perishable goods and a chiller.

Section C provides three refrigerated carts for short term storage of perishable goods and a chiller located below the electrical modules.

Section D also provides three refrigerated carts for short term storage of perishable goods and a chiller located below the crew lockers and dry goods storage.

Section E provides the beer keg storage and refrigeration areas with two chillers.

Section F provides mail bag storage and three mail carts that can be secured with locking latches.

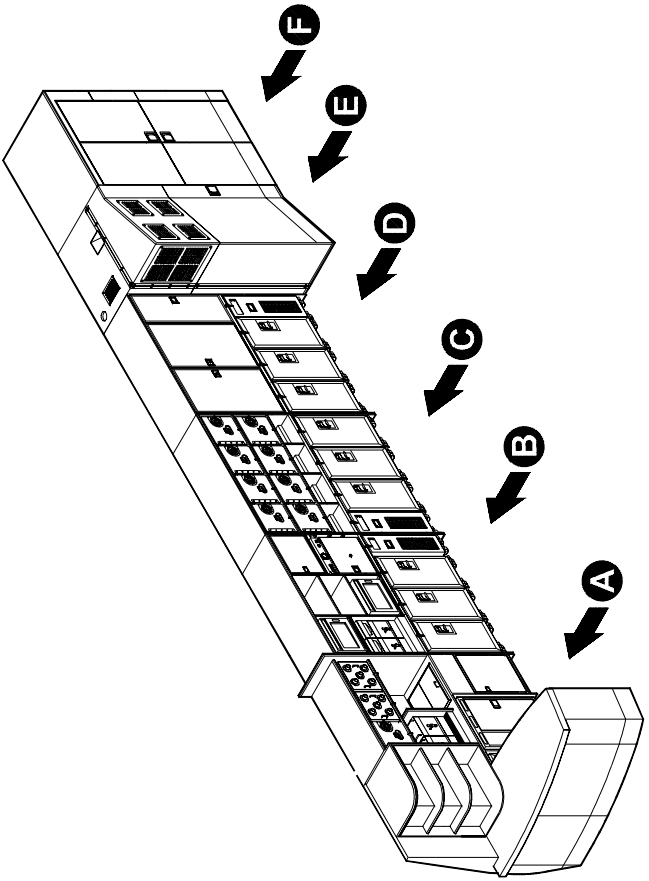
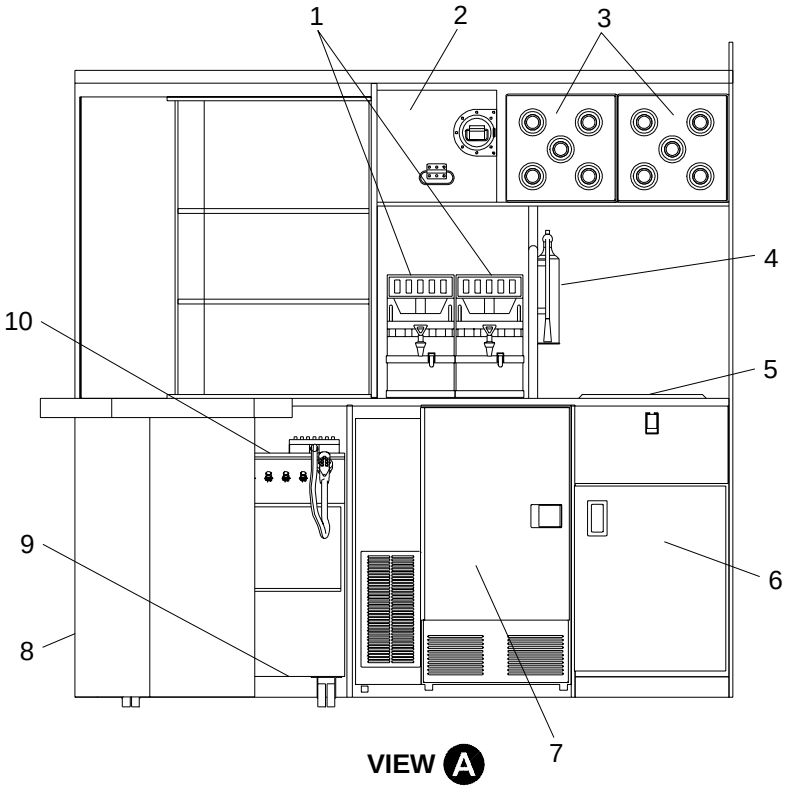


Figure 4-1
Outboard Galley

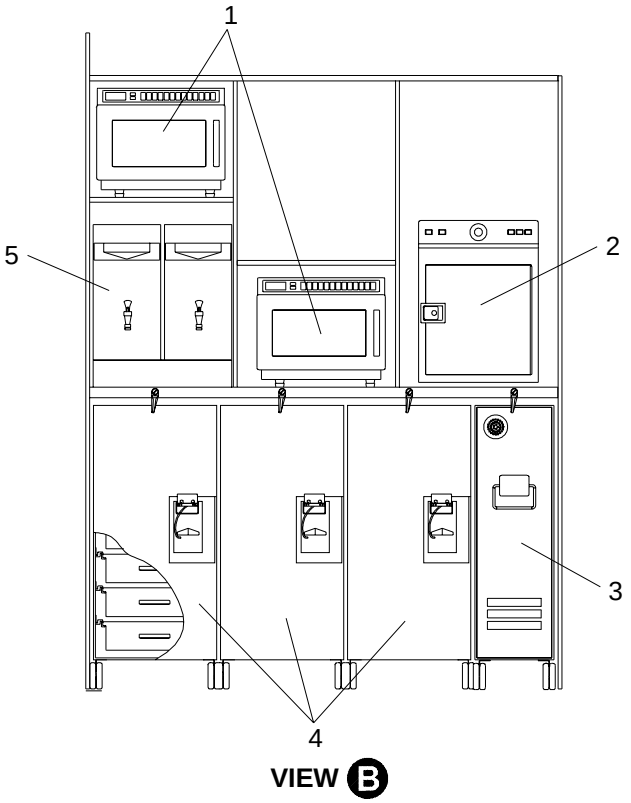
AB270059



AB270061

1. Brewmatic Coffee Tank
2. Standard Container
3. 5-Cup Dispensing Module
4. Fire Extinguisher
5. Ice Storage Top Access Door
6. Ice Storage
7. Refrigerator
8. Panic Door
9. Soda Cart
10. Soda System

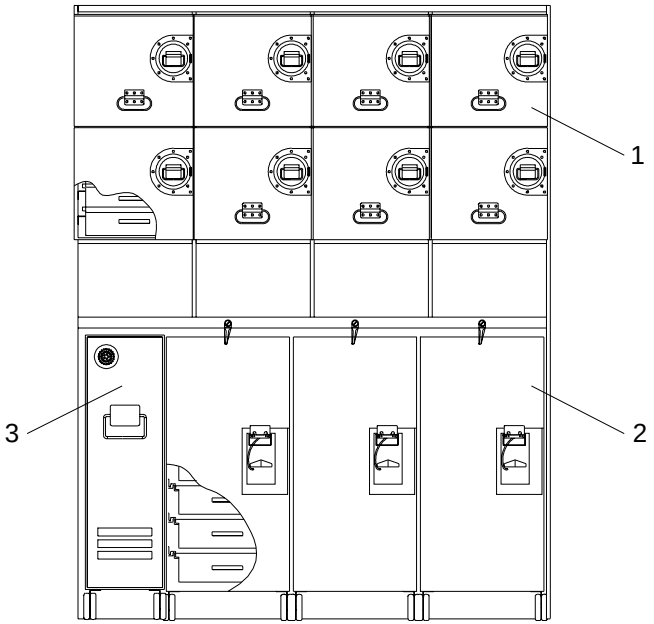
Figure 4-2
Outboard Galley - Section A



AB270062

1. Microwave Oven
2. Convection Oven
3. Air Chiller Unit
4. Standard Cart
5. Coffee Maker

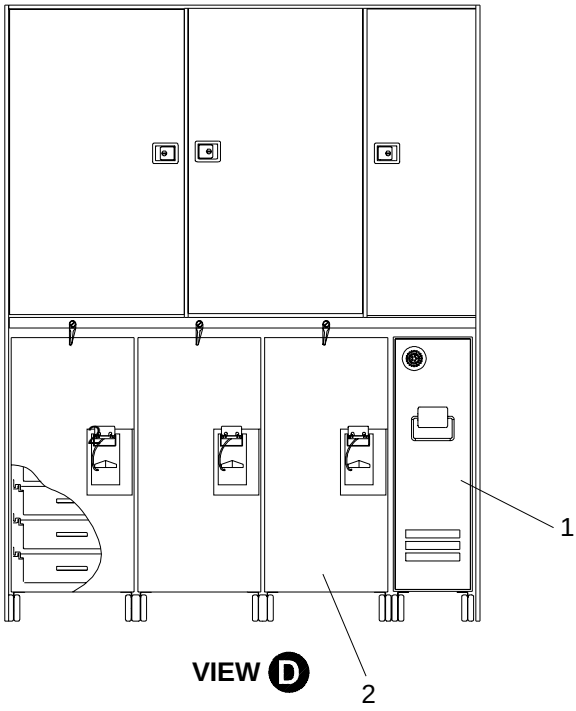
Figure 4-3
Outboard Galley - Section B



AB270063

1. Standard Container
2. Standard Cart
3. Air Chiller Unit

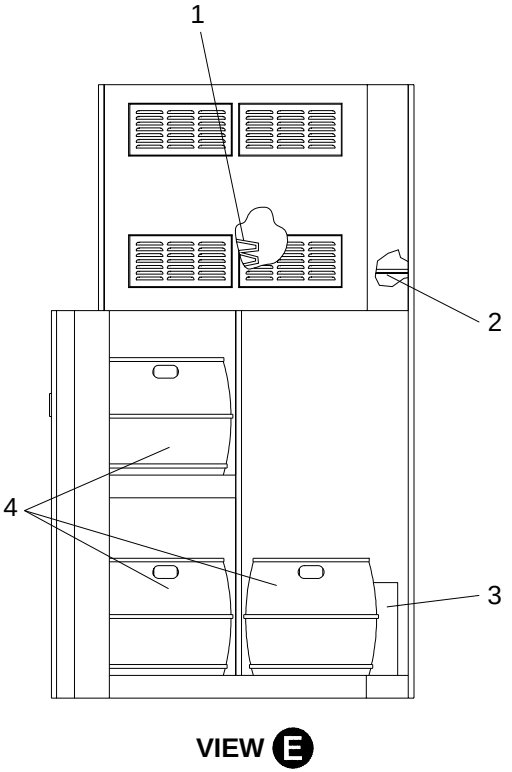
Figure 4-4
Outboard Galley - Section C



AB270064

1. Air Chiller Unit
2. Standard Cart

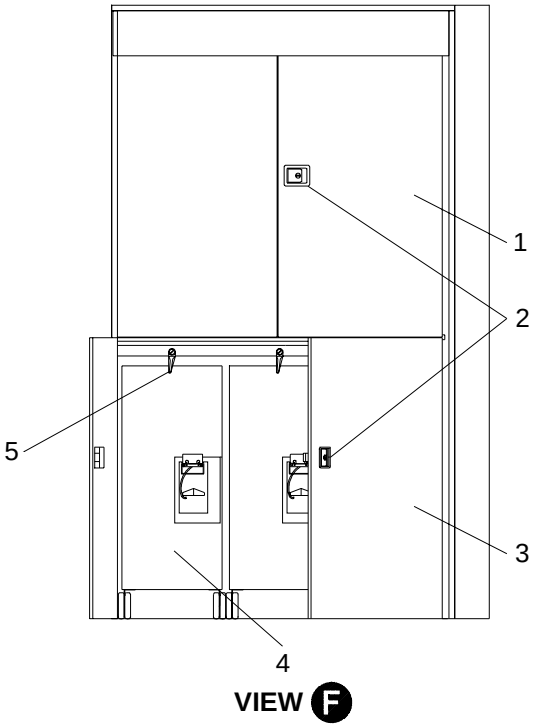
Figure 4-5
Outboard Galley - Section D



AB270065

1. Glycol Chiller
2. Beer Keg Chiller
3. CO^2 Tanks
4. Beer Keg

Figure 4-6
Outboard Galley - Section E



AB270066

1. Mail Bag Storage Compartment
2. Lockable Latch
3. Access Door
4. Standard Mail Cart
5. Cart Retainer

Figure 4-7
Outboard Galley - Section F

4.1.1.2 Inboard Galley (Fig. 4-8 to 4-12). Section G is the access door to the cafe galley. Section H provides display carrier, ice storage, compartments, mop closet, and folding seat. It also provides a sink used for washing utensils. There is another sink in the mop closet for cleaning the mop. This section is also equipped with a fire extinguisher and a first aid kit. Section J provides a communication station, attendant call annunciation panel, video monitor, folding chair, standard trash cart, see-through trolley, freezer, toaster, and containers. Section K provides a faucet, soap dispenser, security drawer, soda storage compartment, heater, beer in-line reservoir, and beer dispenser.

4.1.2 REFRIGERATION SYSTEM. All refrigeration units operate within a range of car interior temperatures from 55 °F up to 105°F. When the ambient temperatures falls to 54 °F or less, the unit enters in standby mode, and displays a "Low Ambient Temp" indication. The unit resumes normal operation when the ambient temperature rises to 60 °F or above. If the car ambient temperature is 105 °F or higher, the unit enters in standby mode, and displays a "High Ambient Temp" indication until the temperature drops to 100 °F or lower.

The air chillers supply temperature range, shown on the display, should be between 28 °F and 30 °F. The return temperature should be between 39 °F and 42 °F

The refrigerator display should show a temperature between 33 °F and 38 °F.

NOTE:

Frequent door openings may momentarily raise the temperature. The displayed temperature is most accurate when the door has been shut for 5 or more minutes.

The freezer should indicate a temperature between -15 °F and -5 °F. At some times, the displayed temperature may drop below -15 °F or above -5 °F. In these cases, the unit should take a minute to reestablished the correct temperature.

A thermometer located in the beer locker monitors its temperature. The average air temperature in the locker should be about 38 °F, if the 28 °F to 32 °F air is supplied by the air chiller.

When loaded food carts are ready to be inserted in the galley, the air chiller can be started as soon as one cart is installed. The system can be prechilled, using one empty cart inserted in the galley.

NOTE:

Without any carts in the galley, there is no path for the airflow, and the ducting and related parts do not get prechilled. In order to maintain the entire system at the best temperature, install at least one cart.

The refrigerators and freezers should be operated well in advance of loading food products to ensure proper interior temperatures. It may take anywhere from 20 to 40 minutes for the unit to reach its operating temperature. The unit display provides an indication that enables the user to estimate when it may be loaded.

The refrigerator and the freezer cycle on and off during normal operation. The unit may sometimes appear to be nonoperational. But it should cycle on again in 5 to 15 minutes when the temperature rises. The cycle times can be reduced if the door is opened continually or if the ambient temperature is very high.

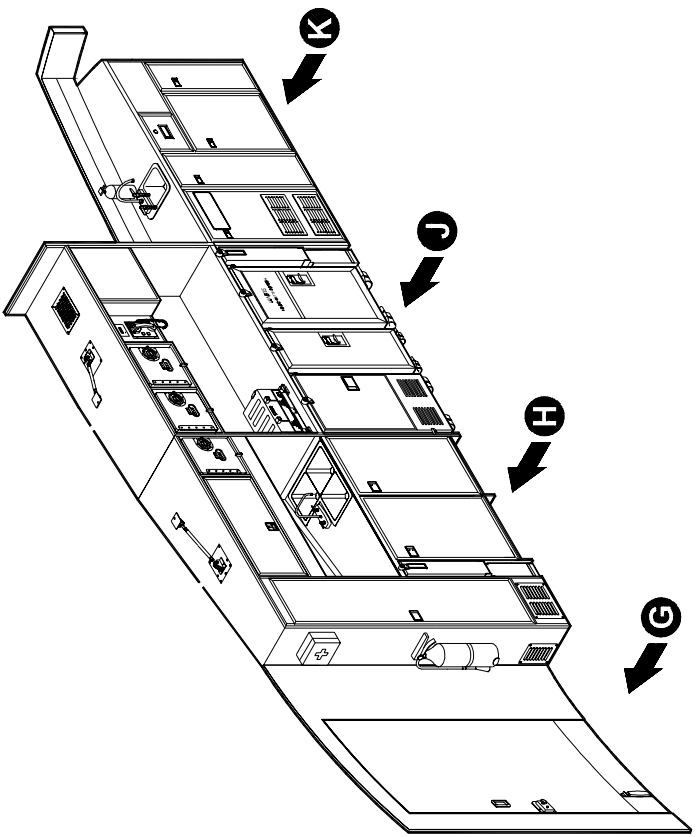
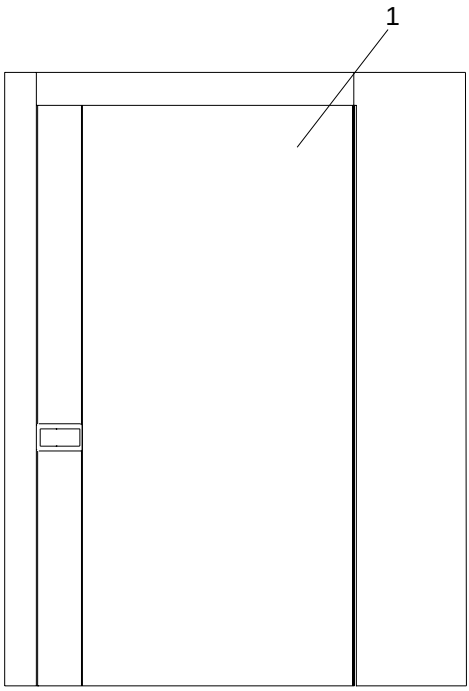


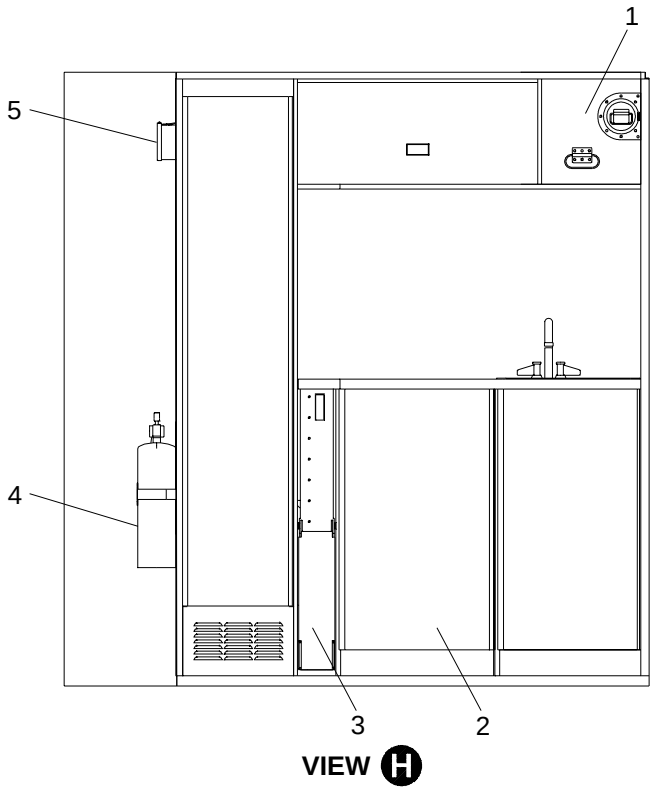
Figure 4-8
Inboard Galley



AB270067

1. Galley Access Door

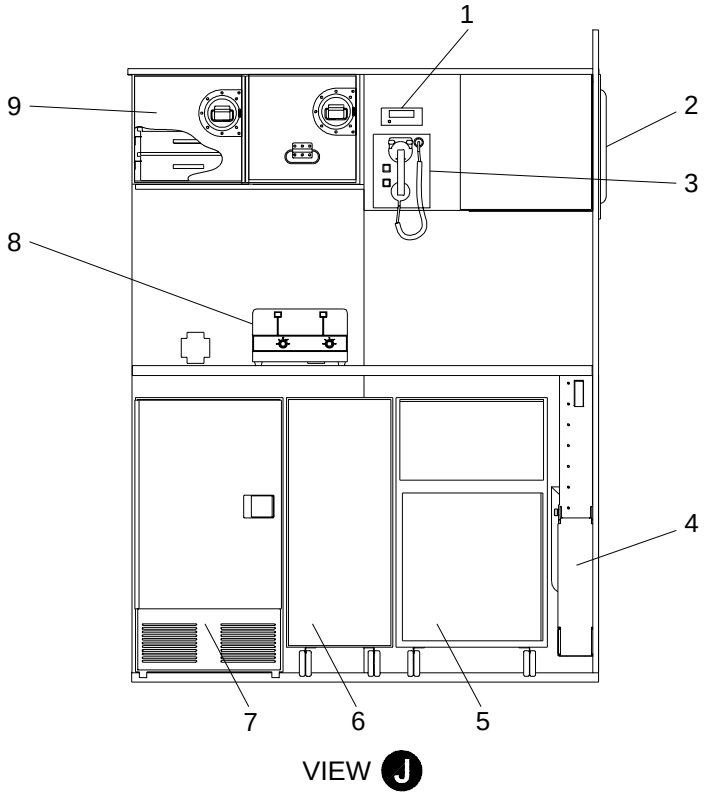
Figure 4-9
Inboard Galley - Section G



AB270068

1. Display Carrier
2. Ice Storage
3. Folding Seat
4. Fire Extinguisher
5. First Aid Kit
6. Mop Closet
7. Sink

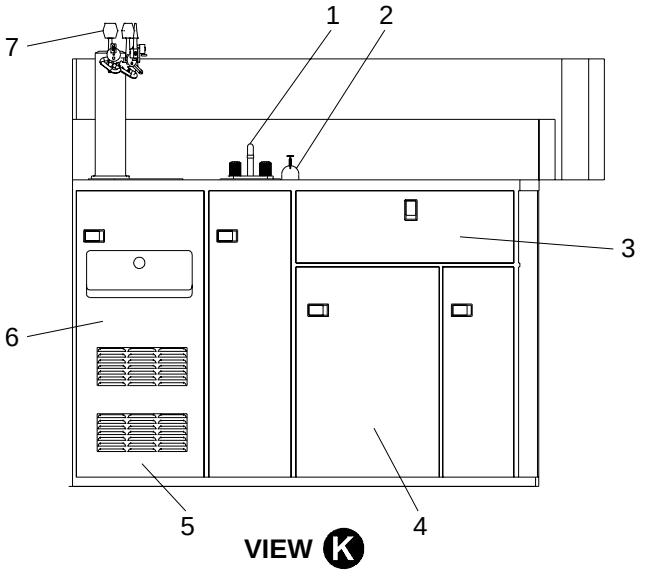
Figure 4-10
Inboard Galley - Section H



AB270070

1. Attendant Call Annunciation Panel
2. Video Monitor
3. Communication Station
4. Folding Chair
5. Standard Trash Cart
6. See-Through Trolley
7. Freezer
8. Toaster
9. Standard Container

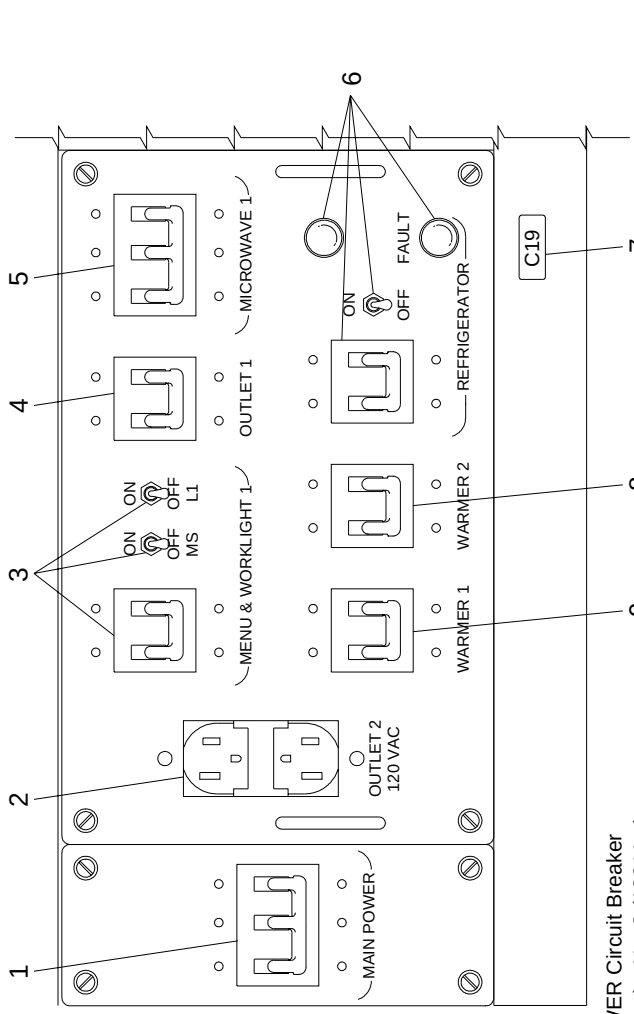
Figure 4-11
Inboard Galley - Section J



AB270071

1. Faucet
2. Soap Dispenser
3. Security Drawer
4. Soda Storage Compartment
5. Heater
6. Beer In-line Reservoir
7. Beer Dispenser

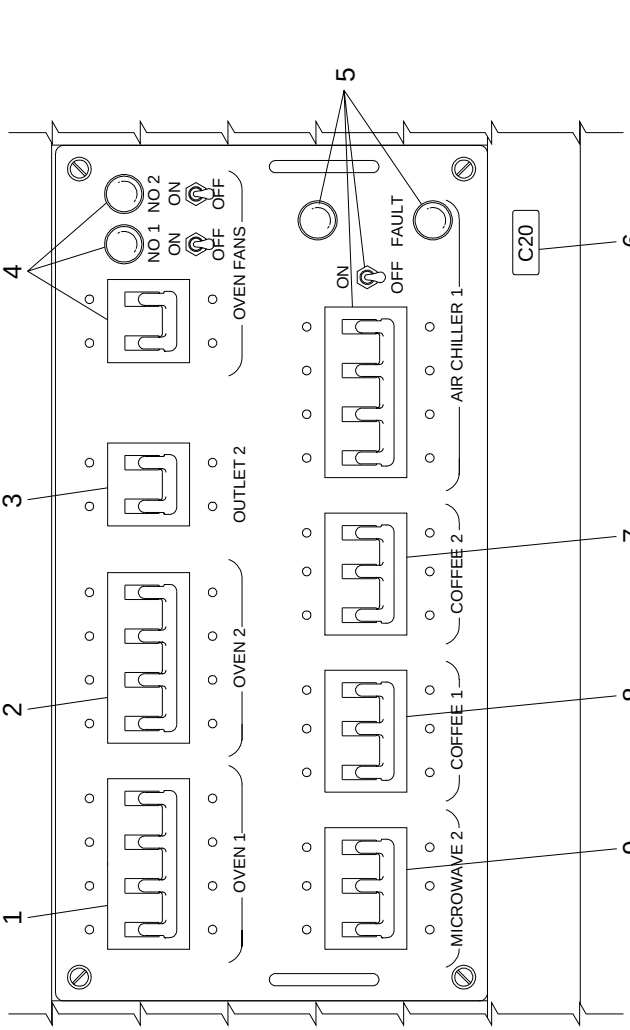
Figure 4-12
Inboard Galley - Section K



1. MAIN POWER Circuit Breaker
2. Electrical Outlet No. 2 (120 Vac)
3. MENU & WORKLIGHT 1 Circuit Breaker, Menu Sign ON/OFF Switch (MS), and Work Light ON/OFF Switch (L1)
4. OUTLET 1 Circuit Breaker
5. MICROWAVE 1 Circuit Breaker
6. REFRIGERATOR Circuit Breaker, ON/OFF Switch, and Indicators
7. C19 Identification Label
8. WARMER 2 Circuit Breaker
9. WARMER 1 Circuit Breaker

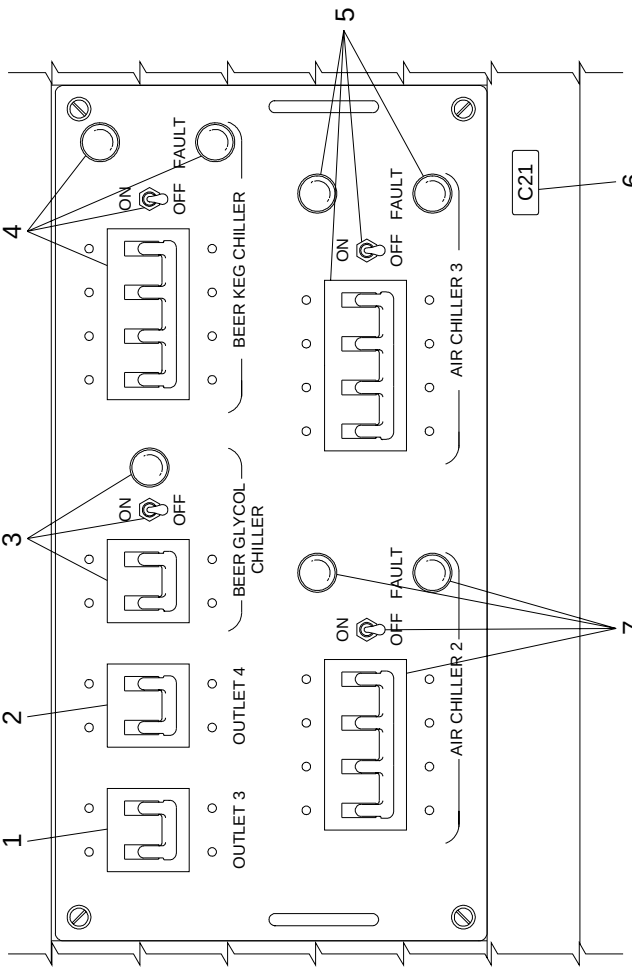
AB270073

Figure 4-13
Cafe Galley Circuit Breaker Panel (C19)



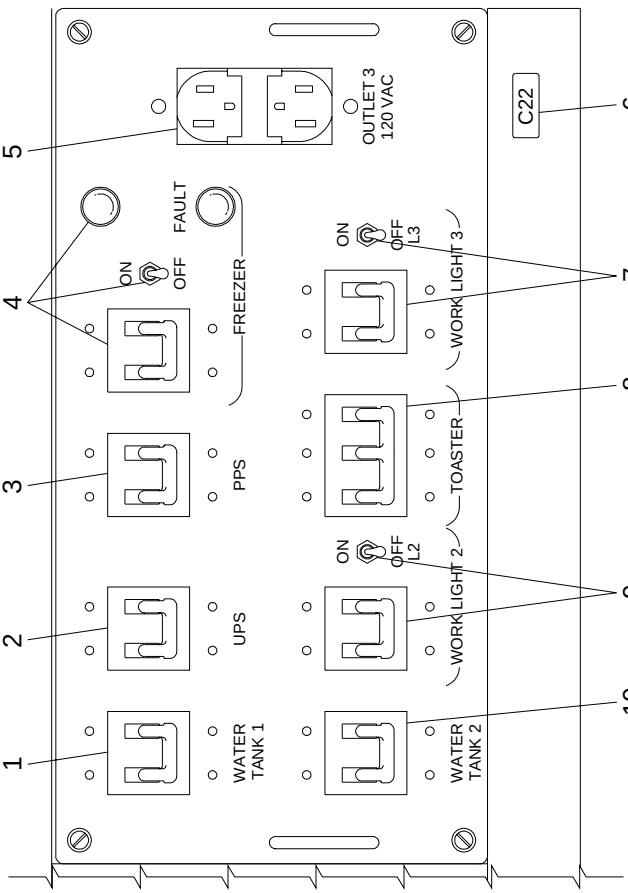
1. OVEN 1 Circuit Breaker
2. OVEN 2 Circuit Breaker
3. OUTLET 2 Circuit Breaker
4. OVEN FANS Circuit Breaker, ON/OFF Switches, and Indicators
5. Air Chiller 1 Circuit Breaker, ON/OFF Switch, and Indicators
6. C20 Identification Label
7. COFFEE 2 Circuit Breaker
8. COFFEE 1 Circuit Breaker
9. MICROWAVE 2 Circuit Breaker

Figure 4-14
Cafe Galley Circuit Breaker Panel (C20)



1. OUTLET 3 Circuit Breaker
2. OUTLET 4 Circuit Breaker
3. BEER GLYCOL CHILLER Circuit Breaker, ON/OFF Switch, and Indicator
4. BEER KEG CHILLER Circuit Breaker, ON/OFF Switch, and Indicators
5. AIR CHILLER 3 Circuit Breaker, ON/OFF Switch, and Indicators
6. C21 Identification Label
7. AIR CHILLER 2 Circuit Breaker, ON/OFF Switch, and Indicators

Figure 4-15
Cafe Galley Circuit Breaker Panel (C21)



AB270076

1. WATER TANK 1 Circuit Breaker
2. UPS (Uninterruptable Power Supply) Circuit Breaker
3. PPS (Power Supply) Circuit Breaker
4. FREEZER Circuit Breaker, ON/OFF Switch, and Indicators
5. Electrical Outlet No. 3 (120 Vac)
6. C22 Identification Label
7. WORK LIGHT 3 Circuit Breaker & ON/OFF Switch (L3)
8. TOASTER Circuit Breaker
9. WORK LIGHT 2 Circuit Breaker & ON/OFF Switch (L2)
10. WATER TANK 2 Circuit Breaker

Figure 4-16
Cafe Galley Circuit Breaker Panel (C22)

The beer locker air chiller can be started whenever it is desired to reduce the temperature. It is not necessary to have beer kegs in the storage space, but it is preferable to prechill the compartment prior to loading it with kegs. The keg compartment door should be closed whenever the air chiller is operational.

NOTE:

If the door beer locker is to be opened for more than 5 minutes, the beer locker air chiller should be turned off.

4.1.2.1 Refrigerator. The refrigerator keeps its contents at a temperature between 33 °F and 38 °F. The refrigerator is mounted on wheels and can be rolled into the galley compartment when changing or installing the unit.

CAUTION:

The condenser fan, at the rear of the refrigerator, discharges air through the back wall of the galley. Any time a refrigerator is removed/replaced, it must verify that the opening in the galley panel is clear and free from blockage. Any blockage reduces the condenser fan flow and inhibits system performance.

The refrigerator remains on all the time when its power switch is activated. The display is illuminated, and shows a temperature or a message. The unit may remain off for 15 to 20 minutes, depending on the use, but the display remains on.

NOTE:

If the display is on and the compressor and fan are not operating for longer than 30 minutes, a problem may have occurred and the display should show a diagnostic message describing the nature of the problem.

Make sure that door openings are short, with about a minute (on average) with the door closed to recover until the next opening.

WARNING:

AVOID LONG, SUSTAINED PERIODS WHEN THE DOOR IS OPEN. THIS MAY CAUSE THE FOOD TO RISE IN TEMPERATURE UP TO THE POINT THAT FOOD SAFETY IS NO LONGER ASSURED.

4.1.2.2 Freezer. The freezer keeps its contents frozen at a temperature between -15 °F and -5 °F. The freezer is mounted on wheels and can be rolled into the galley compartment.

The freezer remains on all the time when its power switch is activated. The display is illuminated, and shows a temperature or a message. The unit may remain off for 10 to 15 minutes, depending on the use, but the display remains on.

NOTE:

If the display is on and the compressor and fan are not operating for longer than 20 minutes, a problem may have occurred and the display should show a diagnostic message describing the nature of the problem.

WARNING:

AVOID LONG, SUSTAINED PERIODS WHEN THE DOOR IS OPEN. THIS MAY CAUSE THE FOOD TO RISE IN TEMPERATURE UP TO THE POINT THAT FOOD SAFETY IS NO LONGER ASSURED.

4.1.2.3 Air Chiller. The air chiller provides chilled air needed to keep the contents of food service carts at a safe and healthful storage temperature.

The chiller is designed to provide air to the food service carts at a nominal 28 °F to 30 °F while the air returning from the carts to the air chiller is normally at 39 °F to 41 °F. When these parameters are met, the food inside the carts is maintained between 33 °F to 39 °F, for long-term storage of ready-to-eat foods.

The air chiller normally remains on all the time when food is being in the galley. It is equipped with a display that indicates the current chilled-air supply and return temperatures. The display also shows diagnostic messages.

The air chiller remains on at all times when the power switch is activated. The display is illuminated, and shows a temperature or a message. The fans operates at all times, except for a brief period (15 to 30 seconds) at the end of the defrost cycle when the fans stop to allow condensate to drain from the unit. If the power switch is on and the display is illuminated, the fans should be on.

NOTE:

If the display is on and the fans are not operating for longer than 30 seconds, a problem may have occurred and the display should show a diagnostic message describing the nature of the problem.

The air chiller is designed to run with one or two carts missing from the system. For long-term operation there should be at least one cart connected to the system for each air chiller. Operating an air chiller for extended periods of time without any carts may create problems with excessive moisture buildup in the air chiller.

If the carts are to be detached from the system for a period of more than 15 minutes, it is recommended that the chiller be turned off until such time as one or more carts is connected to the duct system.

4.1.2.4 Duct System. The duct system is an integral part of the air chiller and cart system. The duct acts to direct the air flow to and from the carts. Air valves installed in the duct direct the flow of air to each cart. The air valves include a bellows to tightly seal against the cart surface, and a door. The door is opened when a cart is in the galley, or closed when the cart is withdrawn. When the air valve is closed, a magnetic strip on the valve door acts to tightly hold the door closed and prevent ambient air from being drawn into the air chiller.

4.1.2.5 Beer System. The beer keg air chiller provides chilled air at approximately 30 °F. This air is distributed to the beer locker area by ducts and plenums that are part of the beer locker. The beer system has the following features:

- Glycol Chiller, which keeps the beer cold through the delivery lines.
- Chill-Pak In-Line Reservoir, which acts as a storage bank for the chilled product.
- Chill Pak Cold Draft Arms, which serve as supplementary cold storage reservoirs.

4.1.3 CONVECTION OVEN. The convection oven provides uniform heat over 30 casseroles from 40 °F to 155 °F within 40 minutes. It operates in three normal modes, COOK, SOAK, and HOLD. The blower motor and the heater operate when the power is on, but the door switch and the oven temperature switch are closed. Power to the blower motor and heater is interrupted when the oven door opens.

4.1.4 STANDARD CART. The standard carts are containers on wheels. On the opposite side of the cart lockable door, the back panel has two screened vent holes, an inlet and outlet valve. The cart valves have one valve-actuator, which must be opened or closed depending on the location of the cart in a galley. During transportation, the vent holes must be closed to protect the merchandise from dirt, dust, and other elements. The interior of the cart has glides to allow different sizes of drawer or shelf. Each drawer has a certain amount of stock, placed in the drawers by the caterer. A list of the items placed in the cart drawer is attached on the outside of the cart door for reference. When carts are dedicated to a nonchilled galley, the cart valve-actuator stays in the closed position.

4.1.5 MENU SIGN. The menu sign is an illuminated metal cabinet that displays the types of food, snacks, and beverages available for purchase. It is located above the wraparound service bar of the cafe car.

The menu sign cabinet contains five panels with the following headings:

- Sandwiches
- Snacks
- Soft Beverages
- Beer Selections
- Breakfast.

Each panel supports seven plastic inserts that display the menu of each category for that panel. Ten fluorescent lamps located behind the panels highlight the menu displays and provide additional lighting to the wraparound service bar.

4.1.6 DISPLAY CABINET. The display cabinet is located above the wraparound service bar on the front section of the outboard galley. It incorporates two glass shelves and a curved transparent panel on the outside to display nonperishable items. A continuous hinge allows the cabinet to rotate 180° counterclockwise in the galley aisle to provide access to the back of the cabinet and to the security curtain. Positive latches secure the cabinet in the normal galley operating position and the galley closed position.

4.1.6.1 Security Curtain. The security curtain secures the cafe galley service counter when the galley is closed. When folded in its fully retracted position, it occupies a small space behind the display cabinet. To gain access to the security curtain, the display cabinet has to be rotated 180° to its alternate position. It is secured in place by a strap with quick releases to prevent the curtain from rattling while the train is in motion. Slide latches are incorporated to the security curtain that latch onto catches installed on the window frame, thus locking the curtain in place when pulled out to its fully extended position.

4.1.6.2 Container. The container is a transportable metal box with various sizes of drawers. Its primary use is transporting nonperishable goods, utensils, and other miscellaneous item. Every container is tagged, listing the content and where it is located in the galley.

4.1.6.3 Cup Dispenser. The cup dispenser dispenses hot and cold cups and is located nearest a beverage location. The overall size of the cup dispenser assembly is similar to the size of container. It can be placed in any galley container compartment. The five-cup holders in the dispenser assembly are spring-loaded, to make the cups easily accessible.

4.1.6.4 See-Through Cart. The see-through cart may be used for display and commercial purposes. The cart has provisions for eight transparent drawers. The door of the cart may be opened 270°, it is equipped with a latch with a security seal. The cart brake pedals are set as follows: the red pedal sets the brake, and the green pedal releases the brakes.

4.1.6.5 See-Through Container. The see-through container is primarily used for display purposes. The container walls, including the door, are made from a clear polycarbonate material. The container has provisions for two five-inch high drawers. The door has a rotary latch with a security seal provision.

4.1.6.6 Trash Cart. The trash cart has the same structural features as the chilled cart. It has identical door latching and cartwheel braking system. however, this cart differs in overall width and has two waste flaps. The waste flap in the cart door swings to the inside. When the flap is released, gravity closes the flap, and magnets in the door panel prevent the flap from swinging open during train movements. The second flap is on top of the cart. It swings open 180° and stays open until manually closed. A waste container collects the disposed waste.

4.1.6.7 Soap Dispenser. The soap dispenser is attached to the edge of sink. It dispenses the soap directly over the sink preventing any spillage on the work deck.

4.1.7 BEVERAGE GALLEY (Fig. 4-17). The beverage galley is located in the first class car and in the end coach car. It has a service countertop from which cold (soft drinks, juices, beer and wine) and hot drinks (coffee, tea, and hot chocolate) can be purchased. An insulated stowage compartment provides stowage for ice bags, and the insulated ice drawer above the compartment dispenses ice.

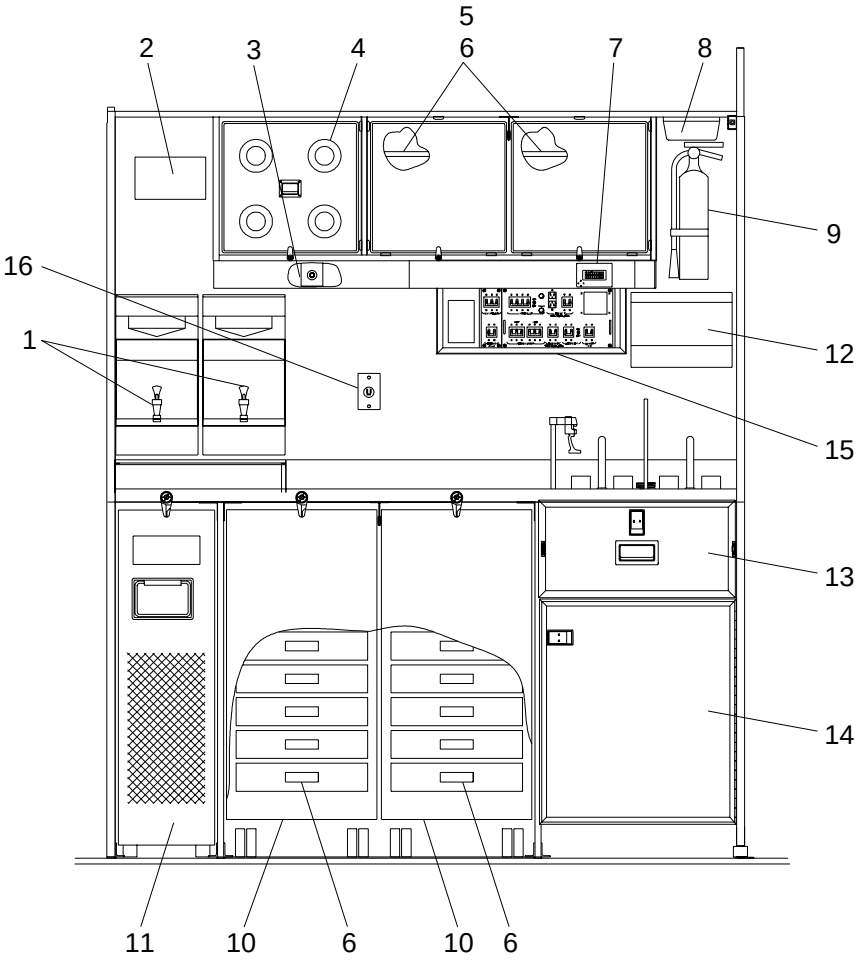
The beverage galley is equipped to provide coffee, water, and sodas. A chiller supplies cold air to the refrigerated carts. Two coffee brewers provide coffee and a hot water heater provides hot water. There is an ice drawer and storage area for ice. An electrical panel provides control for electrical components and an attendant call annunciation panel gives indication of needed customer assistance.

NOTE:

The beverage galley in the end coach car can be locked up with security panels, but the first class car beverage galley cannot be locked up.

CAUTION:

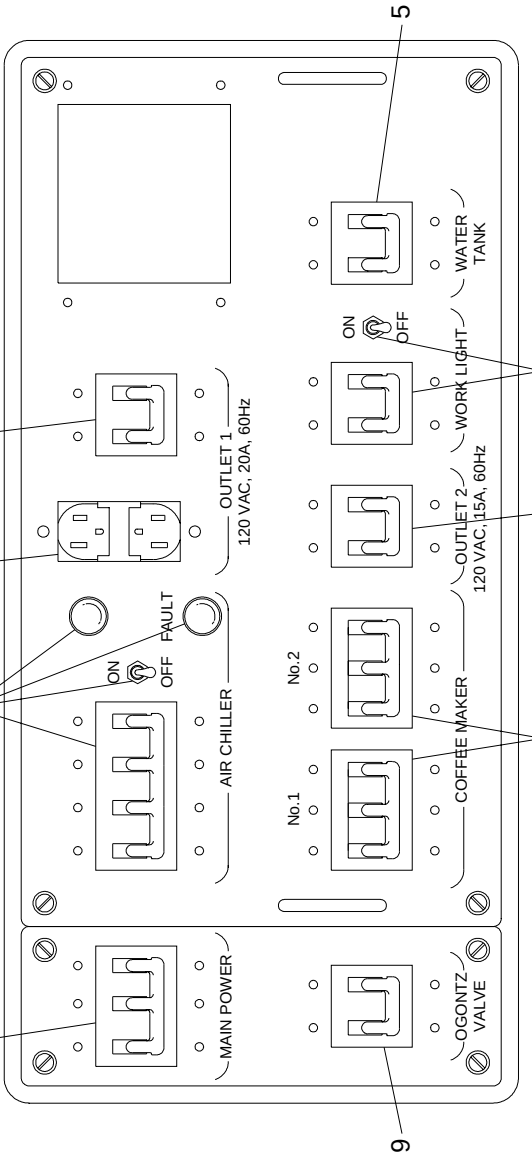
Due to restricted space under the beverage galley bar, the hot water tank is never totally empty. To avoid damage to the hot water tank when a car is parked in the yard, it is necessary to remove the water filter in order to drain all water from the tank.



AB160001

1. Coffee Brewer
2. First Aid Kit
3. Temperature Sensor
4. Cup Dispenser Module
5. Standard Carrier
6. Standard Drawer
7. Attendant Call Annunciation Panel
8. Smoke Detector
9. Fire Extinguisher
10. Refrigerated Cart
11. Chiller Unit
12. Paper Towel Dispenser
13. Ice Drawer
14. Ice Storage
15. Circuit Breaker Panel
16. Electrical Outlet

Figure 4-17
Beverage Galley - End Coach Car and First Class Car



1. MAIN POWER Circuit Breaker
2. AIR CHILLER Circuit Breaker, ON/OFF Switch, & Indicators
3. OUTLET 1, 120 VAC, 20 A, 60 Hz
4. OUTLET 1 Circuit Breaker
5. WATER TANK Circuit Breaker
6. WORK LIGHT Circuit Breaker and ON/OFF Switch
7. OUTLET 2, 120 VAC, 15 A, 60 Hz Circuit Breaker
8. COFFEE MAKER No. 1 and No. 2 Circuit Breakers
9. OGONTZ VALVE Circuit Breaker

Figure 4-18
Beverage Galley Circuit Breaker Panel

4.1.8 FOOD GALLEY (Fig. 4-19). The food galley is located in the first class car, opposite the beverage galley. It is equipped with chilled carts and containers with prepared foods and desserts. The galley is equipped to heat dinners, keep desserts chilled, and quickly heat items in the microwave oven and or the convection oven.

The food galley includes a chiller to supply cold air to the three refrigerated carts, a convection oven, a microwave oven, and a toaster to prepare and heat different foods. The control of electrical components are found in an electrical panel.

4.1.9 CREW OFFICE. The crew office of the cafe car contains the equipment described in the following subsections.

Refer to subsection 2.1.12, on page 2-87, "Train Monitoring and Data Management Systems" for a detailed explanation of the operation of all the crew office equipment related to these systems. The subjects treated in this section include:

- Display Sign Control Menu
- Sign Control Database
- Free Text Message
- Point Of Sale
- Commissary Reports
- Arrow Reservation System
- Arrow Credit Card Transactions.

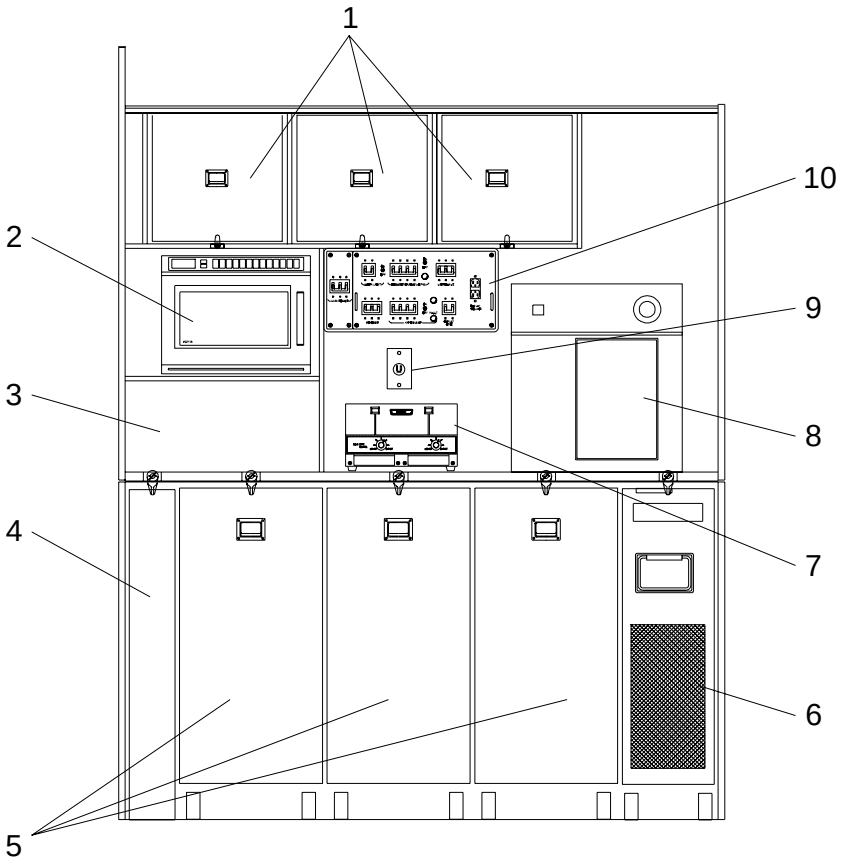
4.1.9.1 Key Card Reader. The key card reader includes a keypad for entering a Personnel Identification Number (PIN). The reader beeps when a key is pressed and a valid key card has been swiped. The key card must be applied against the reading surface to read the coded data. The data is processed by the monitoring system. The monitoring system logs the data and authorizes different access levels to the monitoring information.

The MFDB access levels are detailed in the following table.

Table 4-1. MFDB Access Levels

LEVEL	DESCRIPTION	EQUIPMENT
1	Full access to maintenance data.	MFDB, DMS/WS
2	Full access to maintenance data.	MFDB, DMS/WS
3	Full access to maintenance data.	MFDB, DMS/WS
4	Full access to passenger service data (cafe car only)	MFDB, DMS/WS

Refer to subsection 2.1.9.1, on page 2-58, "Key Card Reader" for a detailed description of the key card reader operation.



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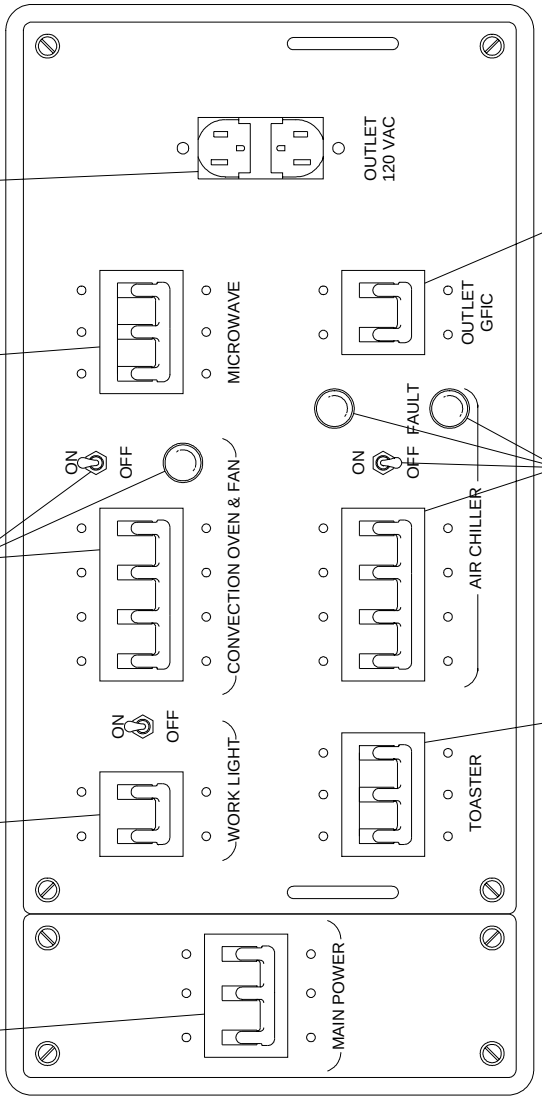
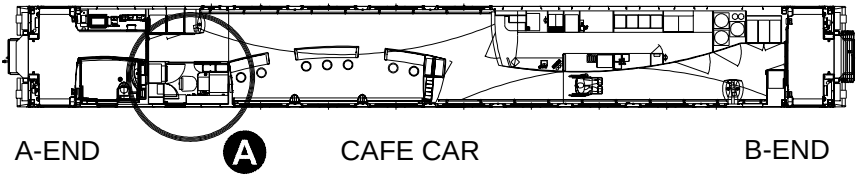
1. Standard Carrier
2. Microwave Oven
3. Tray Storage
4. Folding Seat
5. Refrigerated Carts
6. Chiller Unit
7. Solid State Toaster
8. Convection Oven
9. Electrical Outlet
10. Circuit Breaker Panel

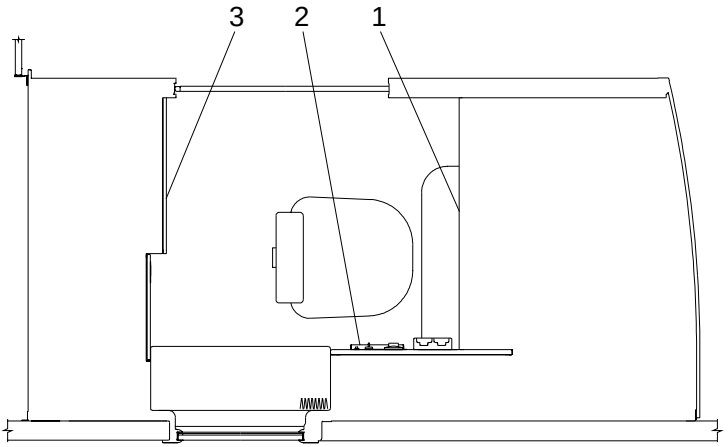
Figure 4-19
Food Galley - First Class Car



1. MAIN POWER Circuit Breaker
2. WORK LIGHT Circuit Breaker and ON/OFF Switch
3. CONVECTION OVEN & FAN Circuit Breaker and ON/OFF Switch
4. MICROWAVE Circuit Breaker
5. 120 Vac Electrical Outlet
6. OUTLET Circuit Breaker, with Ground Fault Indicator
7. AIR CHILLER Circuit Breaker, ON/OFF Switch, & Indicators
8. TOASTER Circuit Breaker

Figure 4-20
Food Galley Circuit Breaker Panel



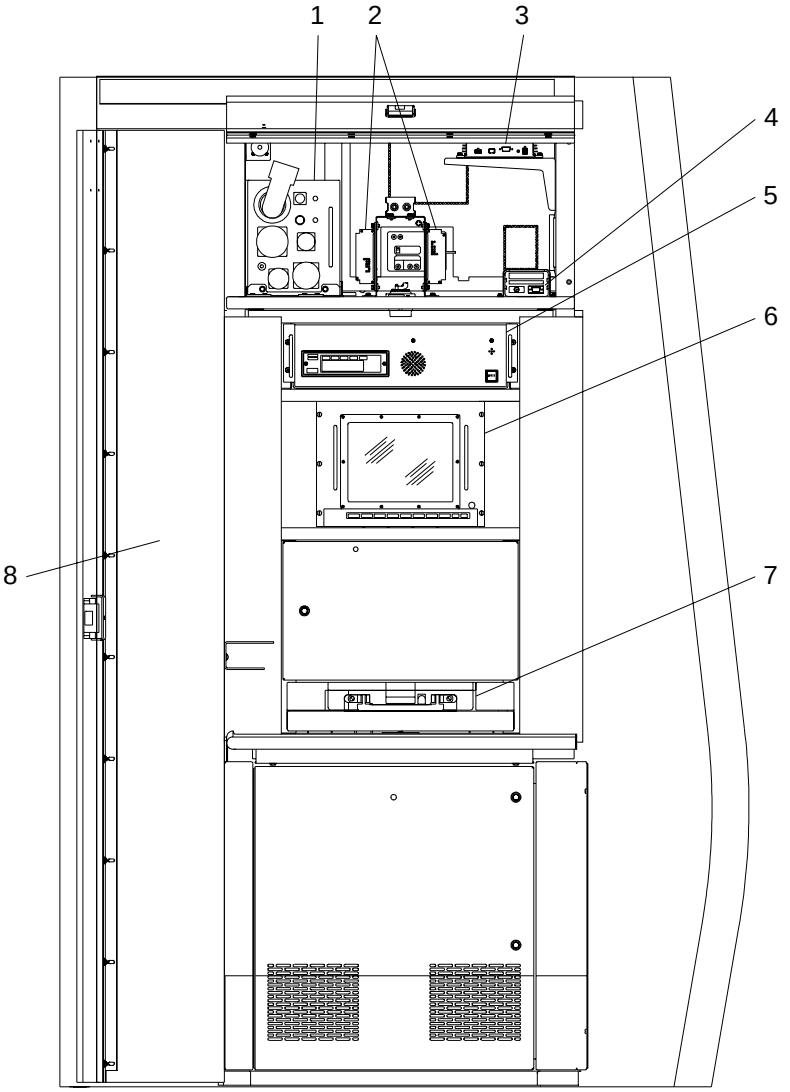


DETAIL A

AB270072

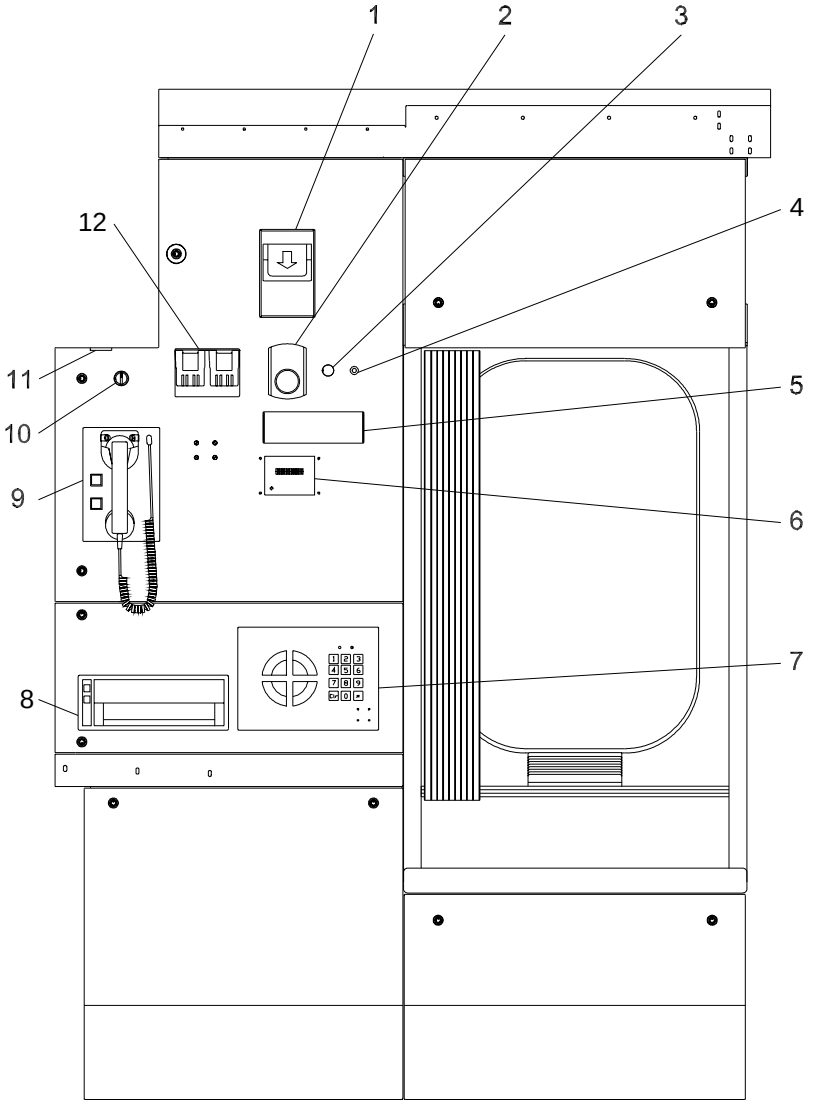
1. Front Wall
2. Right Side Wall
3. Rear Wall

Figure 4-21
Crew Office - Main Divisions



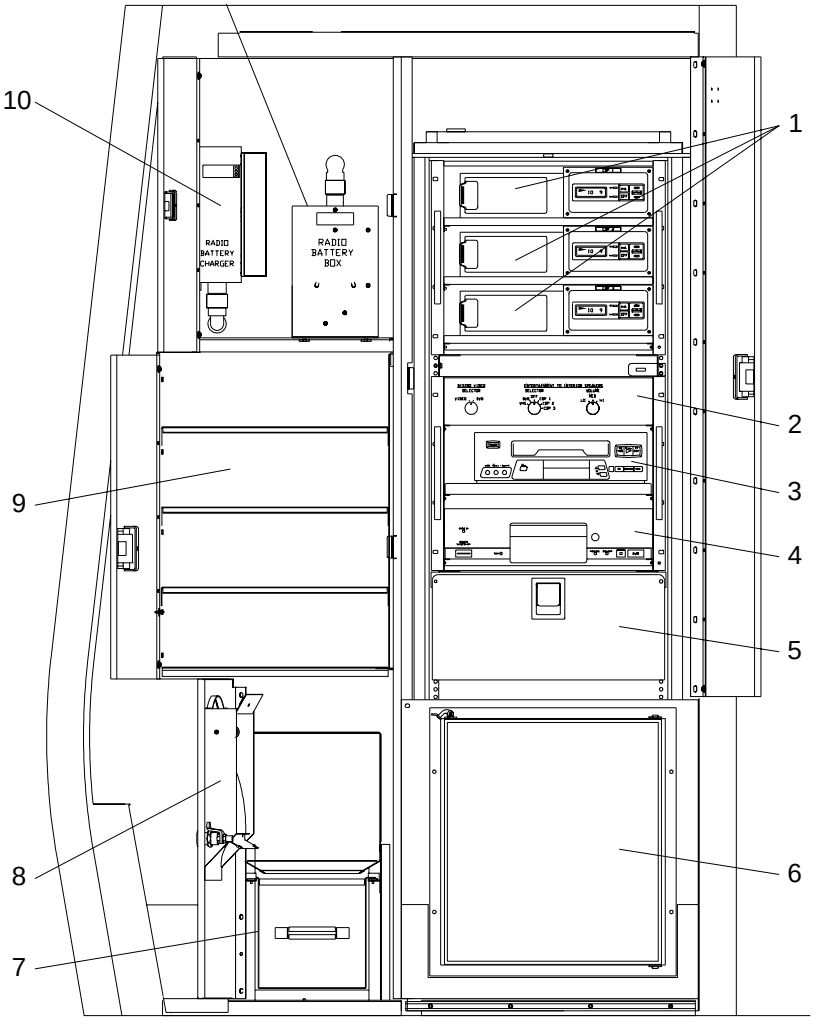
1. Data Management System
2. Power Converter - 72 Vdc - 12 Vdc
3. CDPD Cellular Data Radio
4. RAM Cellular Data Radio
5. Cafe Radio
6. Multifunction Display Cafe
7. Workstation (Laptop) Shelf
8. Storage Locker

Figure 4-22
Crew Office - Front Wall



1. Emergency Brake Valve
2. Thermostat
3. Crew Office Light Switch
4. Reading Light Remote Switch
5. Provision for Credit Card Scanner/ Ticket Reader
6. Attendant Call Annunciation Panel
7. Key Card Reader
8. Printer
9. Communication Station
10. Crew Office Ventilation Switch
11. Reading Light
12. Dual Unit Enhanced Desktop Charger

Figure 4-23
Crew Office - Right Side Wall



1. Compact Disk Player
2. Video System Main Controls
3. Video Home System (VHS)
4. Digital Video Disk (DVD)
5. Storage Drawer for CDs and DVDs
6. Refrigerator
7. Trash Receptacle
8. Trash Locker Door
9. Storage Drawer for VHS Cassettes
10. Radio Battery Charger
11. Radio Battery Box

Figure 4-24
Crew Office - Rear Wall

4.1.9.2 Multifunction Display Cafe. The Multifunction Display Cafe (MFDB) is used by the train conductor to perform various functions. It is functionally identical to the MFD2, with the exception that the pneumatic pressures and the effort gauge are not displayed on the main operations page.

Refer to subsection 2.1.12.9, on page 2-114, "Multifunction Display Cafe (Fig. 2-82 to 2-87)" for an explanation of the operation of this equipment.

4.1.9.3 Workstation. The workstation is a laptop computer that enables transfer of information between wayside facilities and the Data Management System (DMS) using the data radios. It is used as the interface for most passenger related services and certain maintenance related functions. Most passenger related services are either applications running on the workstation, or are peripheral devices connected to it. Refer to subsection 1.4.12.10, on page 1-73, "DMS Interfaces" for the workstation principles of operation, and to subsection 2.1.12.12, on page 2-120, "Workstation" for a detailed description of the equipment.

4.1.9.4 Data Management System. The data management system is an onboard management computer acting as a gateway to a wireless radio network for transfer of train systems data to wayside maintenance and operations facilities. It also provides gateway functions for several onboard passenger services. The DMS has no user interface.

Refer to subsection 1.4.12.10, on page 1-73, "DMS Interfaces" and to subsection 2.1.12, on page 2-87, "Train Monitoring and Data Management Systems" for a detailed description of the DMS.

4.1.9.5 Cafe Radio. The cafe radio is a two-way radio frequency communication unit. The low power two-way repeater radio is used for communication with the trainset handheld radios. The high power two-way radio is used for communication with the wayside radios. Refer to subsection 2.1.8.11, on page 2-52, "Cafe Radio - (BRAD, Bistro Radio) (Fig. 2-31)" for a description of this equipment.

4.1.9.6 Communication Station. The communication station allows crew members to make IC communications and PA announcements. Refer to subsection 2.1.8.12, on page 2-55, "Communication Station (Fig. 2-32)" for a description of this equipment.

4.1.9.7 Attendant Call Annunciation Panel. The attendant call annunciation panel centralizes all the attendant calls of the trainset. It displays the origin (car and area in the car) of each attendant call. It also emits a sound when an attendant call button has been pressed, and this sound is emitted every 15 seconds as long as there are attendant calls.

4.1.9.8 Data Radios. Two independent data radios, RAM and CDPD, are used to communicate with wayside operations and maintenance facilities using the Northeast Corridor (NEC) Radio Data Networks (RDN). The DMS accesses the network using either the RAM or CPDP data radio according to signal availability, message priority, and cost per packet of information. Each data radio is connected to an antenna located on the roof of the cafe car.

4.1.9.9 Emergency Brake Valve. The emergency brake valve enables the conductor to initiate an emergency brake application in an emergency situation.

4.1.9.10 Printer. The DMS interfaces with a thermal printer in the cafe car crew office. The printer is used to print files such as:

- Train orders
- Passenger manifests
- Commissary reports.

4.1.10 ENTERTAINMENT SYSTEM (Fig. 4-25 to 4-29). The entertainment system provides audio and video services to the passengers. This system is made up of the equipment described in the following subsections.

Refer to subsection 1.4.8.5, on page 1-60, "Entertainment System" for a description of the passenger controls units and interior speakers.

4.1.10.1 Compact Disk Player (Fig. 4-25). The Compact Disk Player (CDP) provides stereophonic audio entertainment for the passengers. The CDP is installed in the crew office of the cafe car. The CDP is made of three compact disk players and a control panel for each compact disk player.

4.1.10.2 Video Monitor (Fig. 4-26). The Video Monitor (TVM) provides color video output. Two TVMs are installed in the cafe car. The TVM is controlled by a remote control and a service module. There is one remote control and one service module needed per monitor group. The remote control operates on two AA batteries.

4.1.10.3 Video System (Fig. 4-27 to 4-29). The video system is a rack-mounted electronics assembly installed in the crew office. It provides the cafe car video services and is made of the following equipment: Video Home System (VHS) player, VHS Remote Control, Digital Video Disk (DVD) player, DVD Remote Control.

4.1.10.3.1 Video System. The main controls of the video system are mounted on top of the rack-mounted electronics assembly. They consist of the following:

- BISTRO VIDEO SELECTOR knob that allows selection between the VHS and the DVD player to be broadcast on the two video monitors in the cafe car.
- ENTERTAINMENT TO INTERIOR SPEAKERS - SELECTOR knob that allows selection of the different sources of audio entertainment to be broadcast to the interior speakers. The following positions are available: VHS, DVD, OFF, CDP1, CDP2, CDP3.
- ENTERTAINMENT TO INTERIOR SPEAKERS - VOLUME knob that allows to set the speakers volume to LO, MED, or HI setting.

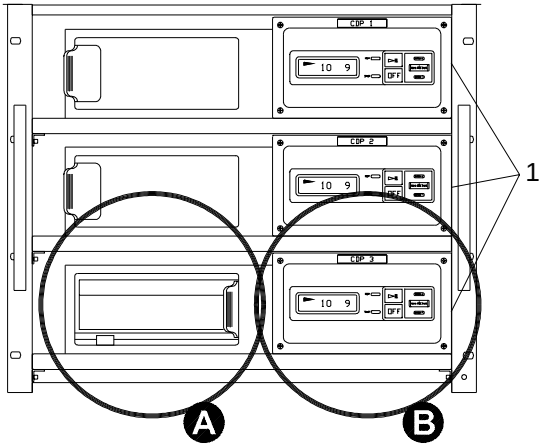
The other components of the video system are as follows:

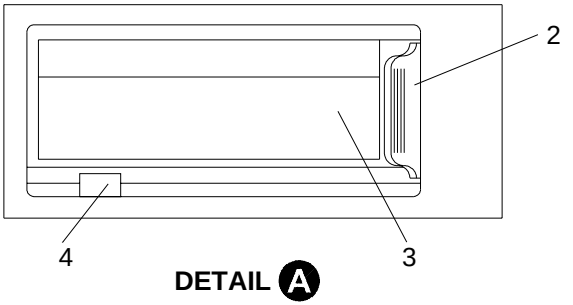
Video Home System (VHS): All the controls required to operate this unit are self-explanatory and are shown on Figure 4-27.

Video Home System (VHS) remote control: All the controls required to operate this unit are self-explanatory and are shown on Figure 4-28.

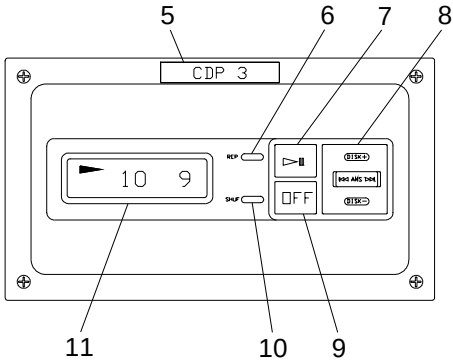
Digital Video Disk (DVD) Player: All the controls required to operate this unit are self-explanatory and are shown on Figure 4-27.

Digital Video Disk (DVD) Remote Control: All the controls required to operate this unit are self-explanatory and are shown on Figure 4-29.





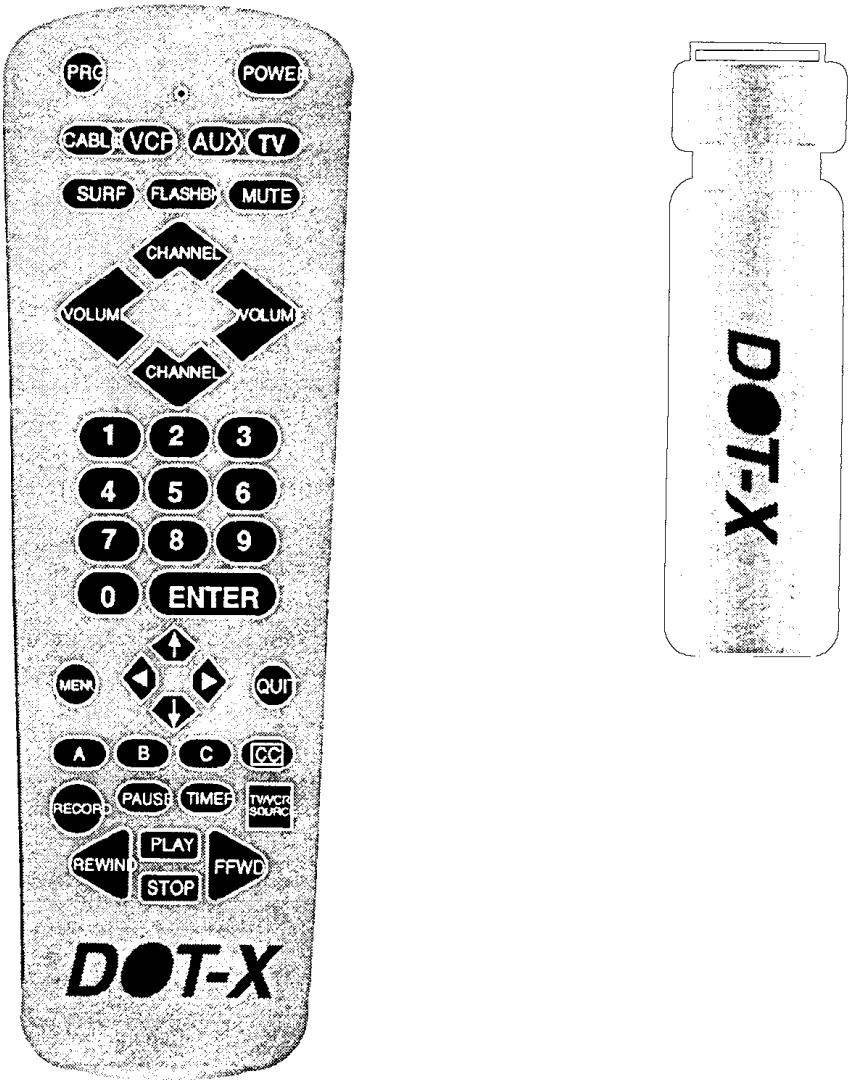
DETAIL A



DETAIL B

1. Compact Disk Player
2. Sliding Access Door
3. Compact Disk Tray
4. Release Button
5. Identification Label
6. Repeat Button
7. Play/Pause Button
8. Main Controls
9. Power Switch
10. Shuffle Button
11. LCD Display

Figure 4-25
Compact Disk Player Unit



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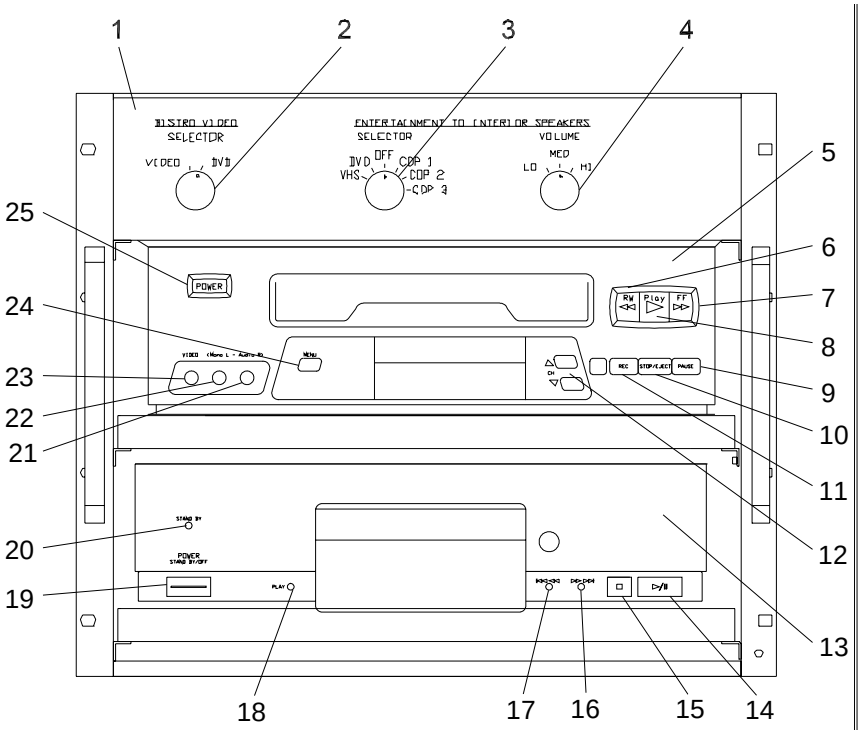
NOTE:

There is one remote needed per monitor group.
The remote operates on two AA batteries.
There is one service module needed per monitor group.

Figure 4-26
Video Monitor Remote Control and Service Module



1. Video System Main Controls
2. BISTRO VIDEO SELECTOR knob
3. ENTERTAINMENT TO INTERIOR SPEAKERS - SELECTOR knob
4. ENTERTAINMENT TO INTERIOR SPEAKERS - VOLUME knob
5. Video Home System (VHS)
6. Rewind Button
7. Fast Forward Button
8. Play Button
9. Pause Button
10. Stop/Eject Button
11. Record Button
12. Channel Selector
13. Digital Video Disk (DVD) Player
14. Play/Pause Button
15. Stop Button
16. Fast Forward Button
17. Rewind Button
18. Play Button
19. Power/Standby/OFF Button
20. Standby Indicator
21. Audio Right Plug
22. Audio Left Plug
23. Video Plug
24. Menu Button
25. Power Switch

Figure 4-27
Video System

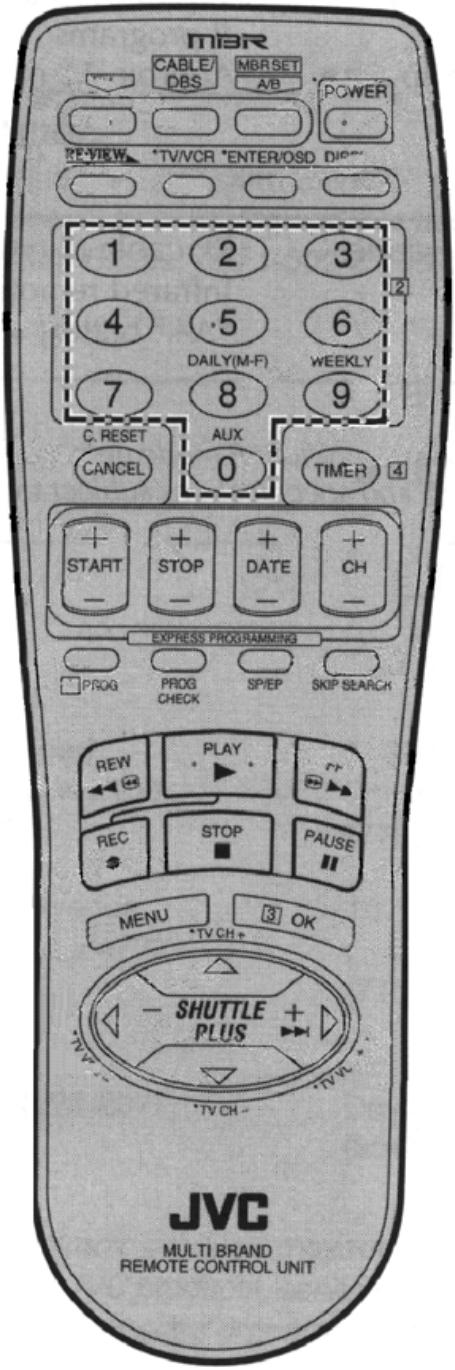


Figure 4-28
Video Home System (VHS) Remote Control

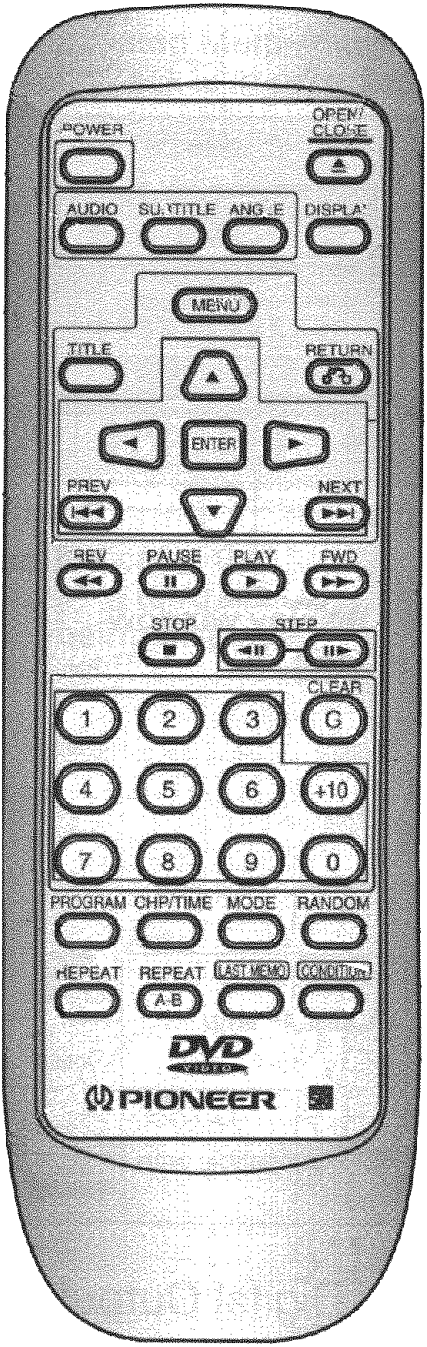


Figure 4-29
Digital Video Disk (DVD) Remote Control

SECTION 4.2
OPERATING INSTRUCTIONS

4.2.1 CAFE GALLEY. To prepare the cafe galley for the next run, it is necessary to open the service counter and display area. This is done by unlocking the door and placing the security curtain in its stowed position. The display cabinet must be also unlatched and rotated into its stowed position and secured. Prior to train departure, the electrical power, main circuit breaker, and circuit breakers for chillers, convection oven, and all other components must be turned on.

4.2.1.1 Beer System Operation. Beer is served at 30 °F ± 1 °F. Chilled glycol is circulated from the glycol chiller through the trunk tubing along with the beer lines. The insulated trunk tubing can support up to 3 different brands of beer.

The prechilled beer and glycol enter into the in-line reservoir, which is located under the bar, very close to the draft arms.

Chilled beer is drawn from the reservoir into the cold draft arm. Glycol is also circulating from the reservoir into the cold draft arm before it is rechilled at the glycol chiller to the specified temperature.

The electronic control of the beer system is located inside the beer locker, on the chiller. It is equipped with the following indicators:

- HC - Hot/Cold run light - This LED indicates compressor is running.
- SF - Sensor Failure light - This LED indicates sensor failed.
- PS - Pressure Switch light - This LED indicates link in line or tank frozen.
- FS - Float Switch light - This LED indicates loss of glycol.

4.2.1.2 Outboard Galley. Controls and indicators are found on the microwave and the convection ovens, and also on the soda system.

For the soda system, the syrup has to be stored above 40 °F and below 90 °F. For best taste results, store syrup between 50 °F and 70 °F.

CAUTION:

Never store syrup below 40 °F. It separates and may not flow through the syrup line.

4.2.2 MICROWAVE OVEN. It is possible to preprogram the number pads and to modify the program. To do so, proceed as indicated below.

- TIME ENTRY - Use to enter heating time without changing preprogrammed number pads.
- MENU b/d - Use to switch between 2 independent preprogrammed menus. Each menu contains up to 10 preprogrammed pads. Pads are programmed to heat for specific time and power level.
- Pads 1 - 0 - Use to begin heating with preprogrammed times and power levels or to enter times for "Manual Time Entry" cooking.
- POWER LEVEL - Use to select power level. If no power level is selected, oven operates at 100% power.

- START - Use to start "Manual Time Entry" program or restart interrupted cooking cycle. Use to save times and power levels when programming pads.
- STOP/RESET - Use to exit programming mode and stop cooking during cooking cycle.

4.2.3 CONVECTION OVEN. To operate the convection oven, proceed as follows:

- Make sure that OVEN circuit breaker is on.
- Place food items to be heated on oven rack and close door.
- Set ON/OFF switch to ON.

NOTE:

The oven blower activates and ON/OFF switch illuminates.

- Set timer to appropriate cooking time.
- Heating elements are energized until oven temperature reaches approximately 355 °F. HEAT ON indicator illuminates.
- Heating elements deenergize, HEAT ON indicator extinguishes, and COOK indicator illuminates.
- If oven temperature falls below 345 °F, COOK indicator extinguishes, heating elements activate, and HEAT ON indicator illuminates.
- When remaining time is less than 10 minutes but greater than 0 minutes, COOK indicator extinguishes (SOAK indicator comes on) and heating elements are deenergized until oven temperature decreases to a minimum of 160 °F.
- When time remaining is ZERO, oven is in HOLD MODE. At this point oven temperature is maintained at 155 °F. COOK and HEAT indicators are extinguished, HOLD indicator illuminates.

4.2.4 STANDARD CARRIER. There is no special instruction related to the operation of the standard carrier. However, the following warning should be adhered to in order to ensure safety.

WARNING:

MAKE SURE THAT BOTH LATCHES ARE PROPERLY CLOSED WHEN THE STANDARD CARRIER IS INSTALLED IN THE GALLEY.

Personnel at the commissary or food caterers stock carts with merchandise under refrigerated condition. These stocked chilled carts are transported to predetermined location and positioned in a galley.

4.2.5 STANDARD CART. When the cart is placed into a galley with a chiller system, the cart valve actuator has to be locked in the open position. Chilled air may then circulate through the carts.

Personnel at the commissary or food caterers stock carts with merchandise under refrigerated condition. These stocked chilled carts are transported to predetermined location and positioned in a galley.

WARNING:

IT IS IMPERATIVE TO OPEN THE VALVE-ACTUATOR ON EVERY CART PRIOR TO PLACING THE CART IN A DESIGNATED POSITION.

The cart brake pedals must be set with the pedals: the red pedal sets the brake, and the green pedal releases the brakes. Additional retainers on the galley work deck must be engaged. When the chilled cart is properly secured in its position it automatically opens a valve system in the galley ducting system, which forces chilled air through the cart to maintain the carts internal temperature.

WARNING:

CLOSE THE VALVE-ACTUATOR ON THE CART PRIOR TO PLACING THE CART IN A DESIGNATED POSITION WHEN IT HOLDS DISCARDED FOOD.

4.2.6 DISPLAY CABINET. Cleaning and loading or unloading of the cabinet is through two doors at the back of the cabinet. The latch lever to lock or unlock the cabinet, when in the normal position, is located above the coffee tanks in the adjacent compartment. The latch to lock or unlock the cabinet, when in the alternate position, is located underneath the cabinet.

To remove and or replace the shelves proceed as follows:

(1) Place cabinet in alternate position.

(2) Open two doors at back of cabinet.

(3) Raise lower shelf up and remove shelf supports out of track by lifting up and out.

(4) Place shelf and supports to bottom of cabinet.

(5) Raise upper shelf up and remove shelf supports out of track and place at bottom of cabinet.

(6) Rotate shelf slightly and remove through larger door. Shelves must be taken out one at a time.

NOTE:

To replace new shelves reverse the procedure.

4.2.7 COFFEE BREWER. The coffee brewer is operated as indicated in the following subsections.

WARNING:

HOT COFFEE MAY CAUSE SERIOUS BURNS. HANDLE HOT COFFEE CAREFULLY.

WARNING:

WARMERS AND OTHER PARTS OF THE BREWER GET HOT. USE EXTREME CAUTION WHEN WORKING AROUND THE BREWER. BE SURE TO TURN OFF THE BREWERS WHEN NOT IN USE.

WARNING:

DO NOT REMOVE THE BREW CONE BEFORE THE COFFEE HAS COMPLETELY DRAINED FROM IT.

WARNING:

THERE IS A DANGER OF SEVERE INJURY ASSOCIATED WITH THE CLEANING OF THE COFFEE MACHINE. AT NO TIME SHOULD ANY CLEANING BE PERFORMED TO THE INTERIOR PARTS OF THE COFFEE MACHINE WHEN IT IS PLUGGED IN OR THE TRAIN IS IN MOTION. IF AT ANY TIME COVERS ARE REMOVED WITH THE INTENTION OF CLEANING THE UNIT, IT MUST BE UNPLUGGED FROM THE WALL OUTLET AND THE MAIN POWER SWITCH PLACED IN OFF POSITION. ANY AND ALL REPAIR IS TO BE PERFORMED BY AN AUTHORIZED AMTRAK SERVICE CENTER.

CAUTION:

Do not leave the power or heating switches in the on position overnight or for extended periods of time.

4.2.7.1 Starting the brew cycle. Proceed as follows:

(1) Turn power switch and heater switch to ON position.

(2) Wait (approximately 20 min.) for "ready light" to come on.

(3) Turn warmer switch on.

(4) Place filter pack in brew cone.

(5) Place brew cone, with coffee, into slides and push it all the way in. Be sure metal tab is down in front of brew cone to keep it in place during travel.

(6) Place a clean, empty, container beneath brew cone and secure container in place with latch.

(7) Press START switch and release.

NOTE:

In a few moments coffee starts to flow into the container.

4.2.8 SOFT DRINKS (SODA SYSTEM) - CAFE CAR). To ensure the passengers get good quality regular and diet soft drinks, taste beverages daily. If the soft drinks do not taste right, check the following items:

(1) Taste water and ice daily.

(2) Check beverage temperature. After serving at least 3 drinks (during nonpeak period), use a thermometer to be sure beverage temperature (without ice) is 40 °F or less. If drink temperature is above 40 °F, tap down ice in cold plate bin and fill bin. Tap down ice 2 to 3 times a day and always keep ice bin full.

(3) Check CO^2 gas regulators daily.

(4) Check syrup-to-water ratio weekly. The perfect tasting drink is realized with 5 parts of water mixed with 1 part of syrup (5:1 ratio).

(5) Rotate syrup. All syrup should be used within 60 days past the production date. Always store syrup above 40 °F and below 90 °F (70 °F for best taste).

(6) Check ice level in cups. Always use 1/3 cup of ice.

(7) Keep equipment clean.

The following are the steps to obtain the correct ratio:

(1) Remove cover. (Undo one acorn nut.)

(2) Install syrup separator tube on dispensing valve. (Push up into nozzle, thus attaching it to syrup outlet.)

(3) Discharge enough product to fill separator tube.

(4) Place ratio cup under valve and fill cup.

SECTION 4.3
TROUBLESHOOTING PROCEDURES

4.3.1 BEER SYSTEM.

INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
Dispenses only warm drinks	Defective recirculation pump or motor pump.	Refer to maintenance personnel
	Defective float switch.	
	Defective controller or thermistor.	

4.3.2 SODA SYSTEM.

INDICATION	CAUSE/*EFFECT*	CORRECTIVE ACTION
No syrup	BIB or syrup tank empty	Replace tank or BIB
	Check connectors	Clean/re-install connector
	Check syrup regulator pressure	Adjust to specified pressure
Flat drink	No water supplied to carbonator	Refer to maintenance personnel
	CO^2 cylinder empty	If pressure is bellow 400 psi, replace the cylinder
	Drink temperature too high	Refer to maintenance personnel
Foaming product	Drink too warm	Temperature should be at 40°F or less
	Accumulation of dirt in nozzles and valves	Clean nozzles
Drink too warm	No ice in bin	Fill ice bin
	Air flow at electrical dispenser obstructed	Test electrical outlet with another appliance
Drink does not taste right	Wrong ratio.	Adjust ratio to 5:1

4.3.3 BEVERAGE GALLEY.

CAR	INDICATION	CAUSE/*EFFECT*	CORRECTION ACTION
EC, FC	No power to beverage galley appliances.	Main power circuit breaker is tripped.	Reset main circuit breaker.
	Work light not operating.	Circuit breaker tripped.	Reset circuit breaker.
	Electrical outlet No. 1 not operating.	Circuit breaker tripped.	Reset circuit breaker.
	Electrical outlet No. 2 not operating.	Circuit breaker tripped.	Reset circuit breaker.
	Temperature sensor not operating.	See Heating, Ventilation, and Air Conditioning.	Refer to maintenance personnel.
	Hot water heater not operating.	Circuit breaker tripped.	Reset circuit breaker.
		Hot water tank not operating.	Refer to maintenance personnel.
	Air chiller not operating.	Circuit breaker tripped.	Reset circuit breaker.
	Coffee machine No. 1 not operating.	Circuit breaker tripped.	Reset circuit breaker.
		Coffee maker on/off switch in OFF position.	Reset coffee maker on/ off switch to ON position.
	Coffee machine No. 2 not operating.	Circuit breaker tripped.	Reset circuit breaker.
		Coffee maker on/off switch in OFF position.	Reset coffee maker on/ off switch to ON position.

4.3.4 REFRIGERATION SYSTEM. Whenever there is a problem with any component of the refrigeration system, proceed as follows to isolate it:

(1) Make sure that galley has power available by verifying that other electrical equipment is operational.

(2) Check if circuit breaker for unit is closed (ON position).

(3) Check that power connector to unit is fully engaged and locked.

(4) Turn unit ON using ON-OFF switch.

NOTE:

The unit display should light up immediately. If everything is within normal limits, the temperatures appear on the display, starting at values close to the car interior temperature.

(5) In a few minutes, the temperature reading should begin to decline. Verify that the display is not showing any messages that might indicate a problem.

(6) For an air chiller, open the cart doors to verify that air is moving through the system.

(7) For a refrigerator or freezer, the walls should begin to chill very quickly, and should continue to get progressively colder.

NOTE:

In some cases the first temperature ON cycle for the refrigerator and freezer may not reach the standard operating temperature when it cycles OFF. It may take one or two temperature cycles to reach the actual set point temperature of the unit.

4.3.5 CONVECTION OVEN. When the convection oven temperature exceeds 500 °F and the power to the oven has not been interrupted by manual means, the overtemperature thermostat opens and interrupts all power to the oven, rendering it inoperative. The overtemperature switch is a manual-reset switch and is only accessible by removing the oven from the galley.

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PREPARATION FOR OPERATION CHECK LIST

OPERATION	RESULT
At the exterior of the trainset, verify that: All pneumatic cutout cocks at each corner of each car are closed. All parking brake manual override levers (4 on each side of each car) are locked in their respective spring plate. Both exterior truck brake cutout cocks (one for each truck, on the left side of each car) are cut in.	All exterior cutout cocks and levers are in normal operating position.
Press step lighting pushbutton.	Access lighting on for one minute.
At the interior of the power car, verify that: Conductor's emergency brake valve is not activated. All penalty magnet valves cutout cocks are cut in. Emergency magnet valve cutout cock is in normal position. All pantograph pneumatic control panel cutout handles are cut in. All propulsion electrical cubicle switches are in NORMAL position. The ATSCO, and SSCO cutout switches (ATC equipment cabinet) are cut in. The ACSES cutout switch (ACSES equipment cabinet) is cut in. Both interior truck brake cutout cocks (one for each truck, on the left side) are cut in. The ITSU and ARU cutout switches (electrical locker No. 1 and No. 2) are cut in. All circuit breakers are in their normal operating position. The pantograph pole, and emergency tools, with first aid kit, are in their proper location.	All interior equipment, including cut-out cocks, levers, and bypass switches, are in normal operating position. All the safety equipment is present.

PREPARATION FOR OPERATION CHECK LIST

OPERATION	RESULT
Press CAB ACTIVATE button.	Monitoring system, key card reader, propulsion control, and auxiliary compressor activated.
NOTE: When the main reservoir pressure is below 90 psi, the auxiliary compressor starts automatically to enable pantograph raising, and close the main circuit breaker.	
Apply key card against key card reader.	Key card reader LEDs indicate the following: Green LED continuously lit: Key card reader is ready to accept a card. Green LED flashing: Card accepted. Red LED continuously lit: Key card reader fault. Red LED flashing: Invalid PIN number entered. Key card reader beeps whenever a status LED is flashing
Type valid PIN number on keypad.	Reverser operation authorized, with traction limitations imposed by access level.
NOTE: If cab is authorized with reverser in other position than OFF, and throttle is in a power position, cycle throttle to "0" and back to power positions to get propulsion controls.	
Set Reverser to N, FWD, or REV.	Cab controls enabled. POD, MFD1, ADU, and other indicators come on.
If step above fails, set opposite cab reverser to OFF.	POD, MFD1, ADU, and other indicators on.
Press PANTO-UP pushbutton.	Pantograph raises.
NOTE: Pantograph raising is in accordance with the setting of the Pantograph Local Selector (PLS) on the propulsion electrical cubicle. If the pantograph is not raising, check all PANTO-DOWN pushbuttons in the train consist for proper position. Press on the pushbutton to regain pantograph control with the PANTO-UP pushbutton.	

PREPARATION FOR OPERATION CHECK LIST

OPERATION	RESULT
Verify MCB switch in AUTO.	Main circuit breaker closed in this position.
Set HEP switch to ON.	Passenger cars supplied.
Set PARKING BRAKE switch to RELEASE.	Parking brakes released.
Verify that throttle is at "0" and ABCL in HO position.	Trainset ready to run.
NOTE: Perform all predeparture tests as listed below.	

TRAINSET DEPARTURE TEST. The departure test is carried out in both power cars of the trainset once every calendar day prior to the departure of the maintenance facility.

PREPARATION FOR TEST. The departure test is carried out after the corrective and preventive maintenance activities have ended in both cabs of the trainset.

NOTE:

The tests steps designated with an * are only required to be completed in the first active lead power car.

If any time any of the test fail, note it on the test report including the step the test failed and notify a supervisor.

NOTE:

Two persons are required to perform the departure tests. Proceed as follows:

WARNING:

PRIOR TO BOARDING, ENSURE THE TRAINSET IS SECURED, WITH WHEEL CHOCKS IN PLACE AND 480 V WAYSIDE POWER DISCONNECTED.

1) Verify if following equipment is in indicated position:

EQUIPMENT	POSITION	LOCATION
Battery Main Circuit Breaker, CB50	ON	Equipment room R-End
Pantograph Local Selector	AUTO	Propulsion Electrical Cubicle
Pressure Pantograph Switch	AUTO	
Key Card Reader Bypass Switch and Fire Control Unit Bypass Switch	NORMAL, sealed	

EQUIPMENT	POSITION	LOCATION
Emergency Magnet Valve Cutout Cock (EMVCC)	Open position (lever vertical)	Equipment Room R-End, right side
ATC cutout switches (ATSCO/SSCO)	IN, sealed	ATC Equipment Rack
Alerter Cutout Switch	NORMAL, sealed	Electrical Locker No. 2
CAB TERRITORY Switch ONBOARD TL Switch	IN, sealed NORMAL, sealed	Cab Rear Wall Switch Panel
Automatic Brake Control Lever	HO (Handle OFF)	Both cabs
Reverser	OFF	Both cabs
BRAKE VALVE C/O Switch	OUT	Both cabs
PANTO-DOWN Pushbutton	Not maintained in "DOWN" position	Both cabs
MCB Switch	AUTO	Engineer's Overhead Switch Panel

2) Press on CAB ACTIVATE button. (MFD2, monitoring system, and key card reader turn on. Auxiliary compressor turns on if air pressure is too low.)

* 3) Verify maintenance events pages on MFD2 to ensure there is no SET maintenance events related to Friction Brakes, ATC/SS/ACSES, Alerter/Event Recorder, and Truck Surveillance. Notify supervisor if any SET maintenance event is present.

* 4) Select propulsion system status and check following status on both power cars:

   - Red: MCB (Open)
   - Gray: K-AUX-2 Contactor Open, HEP supplied from other power car regeneration, rheostatic, traction knockout, lockout, grounding switch, power knockout.
   - Green: HEP On, Rectifiers (4), Choppers (4), MPUs (2), Inverters (3), Pantographs (2), ELD.

5) Apply key card against key card reader and enter valid PIN number.

6) Set reverser to Neutral to enable cab controls and turn on MFD1, POD, and ADU.

7) Verify there are no alarms indicated on Alarms section of MFD1.

8) Press on PANTO-UP pushbutton to raise rear pantograph of leading power car and front pantograph of trailing power car (Pantograph Local Selector set to AUTO).

9) Turn HEP switch to ON. Contactor K-AUX-2 closes to supply whole trainset with 480 V, and main air compressor starts (Main Reservoir pressure should reach at least 130 psi).

10) Wait until Main Reservoir pressure is above 125 psi.

11) On MFD2 (propulsion status), check that contactor K-AUX-2 is yellow (close) on trailing power car, and that MCB is green (close) on both power cars.

BRAKE PREDEPARTURE TEST.

WARNING:

THE TRAINSET BRAKES ARE DISABLED FOR SOME OF THE STEPS IN THE BRAKE PREDEPARTURE TEST. PRIOR TO STARTING THE BRAKE TEST, ENSURE THE TRAINSET IS SECURED, WITH WHEEL CHOCKS IN PLACE. THE APPLICATION/RELEASE TEST TO CHECK PADS AND SHOES MUST BE PERFORMED BY TWO PERSONS.

(1) Select friction brakes subsystem status on MFD2.

(2) Ensure parking brake switch is in APPLY position, and verify that "Parking" indicators are yellow for all cars on MFD2.

(3) Set BRAKE VALVE C/O switch to OUT.

(4) Set ABCL to release (REL). (Equalizing Reservoir starts to charge.)

(5) Wait until Equalizing Reservoir pressure is above Brake Pipe pressure on MFD1.

(6) Set BRAKE VALVE C/O switch to PASS. (Brake Pipe begins to charge.)

(7) Set BRAKE VALVE C/O switch to OUT to ensure Brake Pipe is fully charged.

(8) Set BRAKE VALVE C/O switch to PASS. Repeat last two steps if Brake Pipe is not fully charged. (BP = 110 ± 2 psi on MFD1, BC = 0 psi for all cars on MFD2.)

APPLICATION/RELEASE TEST (TO CHECK PADS AND SHOES).

NOTE:

This test must be performed from the leading power car.

(1) Set ABCL to Full Service (FS). (BP = 81 ± 2 psi on MFD1.) Check if all vehicles respond on MFD2. (BC = 52 ± 4, power cars; BC = 56 ± 4, passenger cars.)

(2) Visually and or manually inspect that brake shoes and pads are firmly seated against the wheels or discs on all cars.

(3) Set ABCL to release (REL). (BP = 110 ± 2 psi on MFD1, BC = 0 psi for all cars on MFD2.)

(4) Set parking brake switch to RELEASE. (Parking indicators turn gray for all cars on MFD2.)

NOTE:

Every 25 seconds, reset the alerter alarm with the Acknowledge switch. (The yellow ALERTER indication disappears on POD.)

(5) Visually and or manually inspect that brake shoes and pads have sufficient clearance from the wheels or discs on all cars. (Brake applied indicators released (IN) on all cars.) Brake shoes total clearance: between 1/2" and 5/8". Brake pads total clearance: between 3/32" and 3/16".

(6) Set parking brake switch to APPLY. (Parking indicators turn yellow for all cars on MFD2.)

APPLICATION TEST.

(7) Verify ABCL is in release (REL). (BP = 110 ± 2 psi on MFD1, BC = 0 psi for all cars on MFD2.)

(8) Move ABCL from REL to Minimum (MIN). (BP = 102 ± 2 psi on MFD1, BC = 18 ± 4 psi for all cars on MFD2.)

(9) Move ABCL from MIN to Suppression (SUP). (BP = 92 ± 2 psi on MFD1, BC = 44 ± 4 psi for all cars on MFD2.)

(10) Move ABCL from SUP to Full Service (FS). (BP = 81 ± 2 psi on MFD1, BC = 52 ± 4 psi for all cars on MFD2.)

GRADUATED RELEASE TEST.

(11) Move ABCL to increase BP pressure approximately 6 psi. (BP = 86 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

(12) Move ABCL from 86 psi to Suppression (SUP). (BP = 92 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

(13) Move ABCL from SUP to Minimum (MIN). (BP = 102 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

(14) Move ABCL from MIN to release (REL). (BP = 110 ± 2 psi on MFD1, ensure BC drops and holds on MFD2.)

INTERACTIVE BRAKE TEST.

STEP DESCRIPTION	MFD1 INDICATION
1) Press "Train Operation" button on MFD1.	No MFD1 indication required.
2) Press "Brakes Test" button.	No MFD1 indication required.
3) Confirm the detected configuration	Detected Configuration Number of Power Cars/Coaches Do you confirm? Yes, No
NOTE: Brake test procedure is enabled.	
4) Press "Initiate" button.	No MFD1 indication required.
NOTE: MFD1 initiates the test and displays step-by-step instructions in the "Test Procedure" section of the screen, as shown in the MFD1 INDICATION column.	
	Preparation for Test:
NOTE: In this brake test, the BRAKE VALVE C/O switch on the engineer's desk right switch panel must be placed in PASS. position.	

STEP DESCRIPTION	MFD1 INDICATION
5) Set ABCL to release (REL) position.	Charge the system BP = 110 ± 2 psi (BC = 0 psi on MFD2)
NOTE:. For safety reasons, the parking brake must have been applied at the end of the Application/Release test.	
	Apply parking brake
6) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify brake pipe air leakage.	Tightness Check (BP Leakage Test)
7) Set ABCL position to SUP position to get a BP pressure reduction of 20 psi from released value, as displayed on BP pressure gauge.	Make 20 PSI BP reduct Brake Pipe drops to 92 ± 2 psi
8) After 30 seconds, move BRAKE VALVE C/O switch to OUT position.	Cut out BP charging
9) Take a reading of the BP pressure and, with a stop watch, wait 3 minutes, and:	After 3 min: check BP reduct
NOTE: To comply with FRA standards, after one minute, the BP reduction should be less than (or equal to) 5 psi.	
10) Take a second reading.	BP reduct not exceed 9 PSI
11) Press Confirm/Next Step button.	Display next Brake Test steps.
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the service portion of the brake system.	Full Service Test
12) Move BRAKE VALVE C/O switch to PASS. position, then move ABCL to release (REL) position.	Cut In BP charge, Rel. brake BP = 110 ± 2 psi
13) After 30 seconds, move ABCL to full service position.	Put ABCL to full service BP = 81 ± 2 psi
14) Take a BC pressure reading on MFD2 to check if all vehicles respond.	Read the BC pressure

STEP DESCRIPTION	MFD1 INDICATION
15) Power Cars: BC = 52 psi ± 4 psi. Coaches: BC = 56 ± 4 psi.	Chk if BC within tolerance
16) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the operation of the brake control computer.	Computer Mode Test
NOTE: The Pneumatic Control Magnet Valve (PCMV) is automatically energized in the Analog Converter position. ER and BP are reduced to 81 ± 2 psi.	
17) Place ABCL to release position.	Put ABCL in release
18) BP pressure should remain at 81 ± 2 psi.	Chk if BP remains at 81 psi
19) Press Confirm/Next Step button.	
The next steps verify the emergency portion of the brake system.	Emergency Brake Test
20) Move ABCL to EMERGENCY position.	Put ABCL to emergency
21) Take a BP pressure reading on MFD1, and a BC pressure reading on MFD2.	Read the BP and BC pressure
22) BP pressure on MFD1 should be 0 psi.	Check if BP dropping to zero
23) BC pressures on MFD2 should be: Power Cars = 60 ± 4 psi. Coaches = 64 ± 4 psi.	Chk if BC within tolerance
24) Wait 60 seconds minimum, then move ABCL to release position.	After 60 S: ABCL to release BP starts to charge.
NOTE: BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	
25) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the emergency mushroom portion of the brake system.	EEPV Test
26) Press the engineer EMERGENCY BRAKE VALVE mushroom, or Engineer's Emergency Pushbutton Valve (EEPV).	Activate the EEPV

STEP DESCRIPTION	MFD1 INDICATION
27) Take a BP pressure reading on MFD1, and a BC pressure reading on MFD2.	Read the BP and BC pressure
28) BP pressure on MFD1 should be 0 psi.	Check if BP dropping to zero
29) BC pressures on MFD2 should be: Power Cars = 60 ± 4 psi. Coaches = 64 ± 4 psi.	Chk if BC within tolerance
30) Wait 60 seconds Minimum, then reset the EMERGENCY BRAKE VALVE mush-room.	After 60 seconds: Reset EEPV
31) To charge the system, move ABCL to handle off, and then to release. BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	
32) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
The next steps verify the emergency magnet valve operation.	EMV Test
NOTE: Wait until the Emergency Magnet Valve (EMV) is deenergized automatically by the computer, venting the BP.	
33) The brake control computer activates the emergency magnet valve automatically.	BCC activates EMV
34) BP pressure on MFD1 should be 0 psi. BC pressures on MFD2 should be: Power Cars = 60 ± 4 psi. Coaches = 64 ± 4 psi.	Chk if all vehicles respond
NOTE: The EMV is reset automatically by the computer.	
35) After 60 seconds, move ABCL to handle off, and then to release. BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	When ER is 0 put ABCL to HO
The next steps verify the pneumatic backup portion of the brake system.	Pneumatic Backup Test
NOTE: The Brake Control Computer deenergizes the Pneumatic Control Magnet Valve (PCMV) for pneumatic operation.	

STEP DESCRIPTION	MFD1 INDICATION
36) Move ABCL to FULL SERVICE position.	Put ABCL to full service BP = 81 ± 2 psi, ER = 81 ± 2 psi
37) Take a BC pressure reading on MFD2.	Read the BC pressure
38) BC pressures on MFD2 should be: Power Cars = 52 ± 4 psi. Coaches = 56 ± 4 psi.	Chck if BC within tolerance
39) Move ABCL to release position.	Put ABCL to release
NOTE: BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	
40) BC pressures on MFD2 should be: Power Cars = 0 psi. Coaches = 0 psi.	Chck if BC within tolerance
NOTE: BP pressure = 110 PSI, BC pressure = 0 PSI.	
41) Press Confirm/Next Step button.	
NOTE: MFD1 displays the next brake test steps.	
NOTE: The brake control computer reenergizes the PCMV for normal operation.	
The next steps verify the electropneumatic portion of the brake system.	EP-Brake Test
BP pressure = 110 psi (MFD1), BC pressure = 0 psi for all cars (MFD2).	Put ABCL in release
NOTE: The ABCL is already in release.	
42) Move ABCL to full service position. Check if all vehicles respond on MFD2. After 4 seconds, BC pressure should be: Power Cars = 49 ± 4 psi Coaches = 53 ± 4 psi.	Put ABCL to full service BP = 81 ± 2 psi, ER = 81 ± 2 psi
43) Wait until brakes are applied and then move ABCL to release.	After 10 S: ABCL to release BP = 110 ± 2 psi.
44) With a stop watch, measure the time to fully release the brakes.	Note the release time
45) The release time should be within tolerances. After 5 seconds, BC pressure should be less than (or equal to) 5 psi.	Chk if rel time wt tolerance

STEP DESCRIPTION	MFD1 INDICATION
46) Press Confirm/Next Step button.	Test Result: Passed
47) Press Print/Record button.	Print OK and Reprint buttons come on.
48) Press Print OK if the report is properly printed. Press Reprint is the report is not properly printed.	No MFD1 indication required.
49) Press Return button.	MFD1 screen displays the Train Operations page.

ATC PREDEPARTURE TEST.

STEP DESCRIPTION	MFD1 INDICATION
NOTE: Next steps are preparation for ATC predeparture test	
1) Verify that ABCL is in release (REL) position.	
2) Set reverser to FORWARD position.	
3) Set effort lever to "0" position.	
4) Ensure that parking brake is applied.	Parking Brake: Applied
NOTE: All parking indicators should be yellow on MFD2.	
5) Ensure there is no code present in track. The Aspect Display Unit (ADU) should indicate restricting aspect (20 mph).	
6) Verify that there is no "Overspeed", "Suppression", and/or "Penalty Application" indications on the POD.	
7) Press ATC Test button.	Display menu choice.
NOTE: Next steps test the ATC in a step-by-step operation.	
8) Press Initiate button.	
The system goes through all aspects of the cab signal, increasing from 0 to 150 mph, and decreasing from 150 mph to 0. The system activates the alarm and displays all overspeed points.	The system will go through all aspects of the cab signal and display all overspeed points

STEP DESCRIPTION	MFD1 INDICATION
Wait until the ADU display shows 150 mph ending the increasing cycle. Then, the POD displays 0 mph. Immediately after, the ADU shows 150 mph again to start the decreasing cycle.	Acknowledge all warnings except Restricted aspect
NOTE: Acknowledge only the warnings when the system is decreasing the cab signal speed, except the last one at 20 mph (restricting aspect).	
9) Acknowledge all signal changes with the ACKNOWLEDGE switch (engineer's desk right switch panel) at: 125 mph 100 mph 80 mph 60 mph 45 mph (approach limited) 30 mph (approach medium) 30 mph (approach)	Alarm turns off when change of speed aspect is acknowledged.
10) Do not acknowledge 20 mph (restricting). Wait until the system automatically initiates a penalty brake application. The overspeed indication status flashes on the POD.	Overspeed indication flashes (after 5 sec.)
11) Five seconds after last downward code change, the ATC triggers a penalty brake.	Verify the brake pipe pressure drop. BP = 81 ± 2 psi.
12) Five seconds after last downward code change, the ATC triggers a penalty brake.	Application indication turns on (within 6 sec).
NOTE: The propulsion control unit turns on the "Penalty Application" on the POD to ensure that the power knockout interface is functional.	
13) Acknowledge to shut off the alarm.	
14) Set ABCL to suppression (SUP) position. Penalty application and overspeed indications turn off. Suppression indication (yellow) turns on.	BP = 92 ± 2 psi.
15) Set ABCL to release (REL) position. Suppression indication (yellow) turns off. BC = 0 psi for all cars on MFD2.	BP = 110 ± 2 psi.

STEP DESCRIPTION	MFD1 INDICATION
16) Set the reverser to neutral.	
17) Press Confirm Result button.	Test Result: Passed
18) Press Print/Record button.	Display menu choices.
19) Press Print OK if report is properly printed.	Display menu choices.
20) Press Return button.	Display menu choices.

ALERTER PREDEPARTURE TEST.

WARNING:
ENSURE THE TRAINSET IS SECURED, WITH WHEEL CHOCKS IN PLACE.

STEP DESCRIPTION	MFD1 INDICATION
1) Verify that the ABCL is in release (REL) position. BC = 0 psi for all cars on MFD2.	BP = 110 ± 2 psi.
2) Release parking brake. Parking brake indicators turn gray on MFD2.	
3) Press Alerter Test button.	Start of Alerter test procedure enabled.
4) Press Initiate button.	Initiate test and display the step-by-step operation.
NOTE: If the ATC is cutout, the alerter cannot be acknowledged by the acknowledge footswitch and whisker switch. One of the other reset functions must be used.	
5) Wait approximately 25 seconds when audible alarm starts and reset the alerter using the ACKNOWLEDGE switch.	Reset the Alerter using various inputs
NOTE: In each case, the alerter yellow indication flashes on the POD and disappears after the acknowledgement.	
6) Wait another 25 seconds when audible alarm starts and reset the alerter by activating the bell.	Reset the Alerter using various inputs
7) Wait another 25 seconds when audible alarm starts and do not reset the alerter.	Do not acknowledge

STEP DESCRIPTION	MFD1 INDICATION
NOTE: The POD alerter yellow indication comes on. The system automatically initiates a penalty brake application. The propulsion control unit turns on the "Penalty Application" on the POD to ensure that the power knockout interface is functional.	
8) Penalty brake should be initiated.	Verify the brake pipe pressure drop and Application indication BP = 81 ± 2 psi.
9) Set ABCL to suppression (SUP) position.	Reset Penalty with brake Suppression (BP = 92 ± 2 psi)
NOTE: The alerter yellow indication and the white penalty application indication disappear on the POD.	
10) Set the parking brake to APPLY position. Parking brake indicators for all cars turn yellow on MFD2.	
11) Set ABCL to release (REL) position. BC = 0 psi for all cars on MFD2.	BP = 110 ± 2 psi
12) Press Confirm Result button.	Test Result: Passed
13) Press Print/Record button.	Display menu choices.
14) Press Print OK if the report is properly printed.	Display menu choices.
15) Press Return button.	Display menu choices.

ITSU PREDEPARTURE TEST.

STEP DESCRIPTION	MFD1 INDICATION
1) Press ITSU Test button.	Display menu choice.
2) Press Initiate button.	1- Initiate the test.
This initiate an ITSU self test and in parallel opens the "on board" trainlines. (The operator should verify and acknowledge that the ONBOARD FAILURE indicator is ON.)	2- Acknowledge that on board light on the console is lit
NOTE: If the test result is passed, press the Confirm/next Car button to test the next car.	
3) Press Confirm/Next Car button.	3- Select the next car button.
4) Continue the sequence until the last car is checked.	4- Continue this sequence until last car.

STEP DESCRIPTION	MFD1 INDICATION
5) Press the Confirm/next Car button to test the next car.	5- Press passed or failed button to confirm test result.
6) Press Print/Record button.	Display menu choices.
7) Press Print OK if the report is properly printed.	Display menu choices.
8) Press Return button.	Display menu choices.
9) Press Return button.	Return to the Main Operations Page of MFD1.

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